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ABSTRACT

Materials containing hazardous substances present serious problems to human health and to the health of the environment. There are many potential problems related to the site of a house or apartment, the construction materials used in the house or the apartment, products and materials used in and around the home, and disposal of materials. Relatively few compilations of instructional materials related to household hazardous materials have been available. This publication was designed to identify problems and concerns that should be included in environmental education programs related to household hazardous material problems and to identify sources of references and instructional materials that can be used for environmental education programs. Education related to hazardous materials in and around the home should be included throughout the school curriculum and from elementary school through secondary school. Materials to support this philosophy are provided to illustrate activities for science, social studies, and language arts for grades 1-12. Sections include: (1) the characteristics of hazardous materials; (2) potential problems related to home construction; (3) potential problems related to materials used in the home; (4) household hazardous waste disposal; (5) actions classes can take in their communities; (6) selected information sources; and (7) selected references. Each of the sections presents some background information on the problem or topic and materials to illustrate some instructional approaches for various grade levels and courses. (CW)

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ACTIVITIES FOR TEACHING ABOUT HAZARDOUS MATERIALS IN THE HOME

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ENVIRONMENTAL EDUCATION INFORMATION REPORTS

Environmental Education Information Reports are issued to analyze and summarize information related to the teaching and learning of environmental education and provide examples of instructional materials and curriculum. It is hoped that these publications will provide information for personnel involved in development, ideas for teachers, and indications of trends in environmental education.

Your comments and suggestions for these publications are invited.

Robert W. Howe
Director
ERIC/SMEAC

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PREFACE

This is the 20th volume in ERIC/SMEAC's Teaching Activities in Environmental Education series, which was initiated in 1973. The first three titles in the series were of a general nature, dealing with multiple aspects of environmental education. Starting with the fourth, topical areas have been identified as themes, with the expectation that such an organizational pattern might prove more useful to practitioners in both formal and non-formal settings.

As a general rule, most of the activities selected for inclusion in the various volumes have been adapted from materials developed by others; many of the source publications have been reported through the ERIC data base, and are available in ERIC documents. Some have been "original," in the sense that ERIC staff or other authors have developed them more or less from scratch. Common formats have been employed for all activities in each volume.

The current volume was developed by Robert Howe, John Disinger and Terry Wilson. Most of the activities are based on reports, instructional materials, and other information located through the ERIC system, as referenced. Activities include a mix of original and adapted materials.

Other titles in the Teaching Activities in Environmental Education series include:

John H. Wheatley and Herbert L. Coon, One Hundred Teaching Activities in Environmental Education. 1973; ED 091 172; 204 pages.

John H. Wheatley and Herbert L. Coon, Teaching Activities in Environmental Education, Volume II. 1974; ED 102 031; 200 pages.

John H. Wheatley and Herbert L. Coon, Teaching Activities in Environmental Education, Volume III. 1975; ED 125 268; 195 pages.

Herbert L. Coon and Michele Y. Alexander, Energy Activities for the Classroom. 1976; ED 130 833; 148 pages.

Herbert L. Coon and Mary Lynne Bowman, Environmental Education in the Urban Setting: Rationale and Teaching Activities. 1977; ED 137 140; 199 pages.

Judith M. Schultz and Herbert L. Coon, Population Education Activities for the Classroom. 1977; ED 141 178; 195 pages.

Robert H. McCabe, J. Terence Kelly, and Doris Lyons, Man and Environment Teaching Activities. 1977; ED 144 626; 336 pages.

Herbert L. Coon and Charles L. Price, Water-Related Teaching Activities. 1977; ED 150 026; 156 pages.

Mary Lynne Bowman and John F. Disinger, Land Use Management Activities for the Classroom. 1977; ED 152 541; 265 pages.

Mary Lynne Bowman and Herbert L. Coon, Recycling: Activities for the Classroom. 1978; ED 159 075; 145 pages.

William R. Hernbrode, Multidisciplinary Wildlife Teaching Activities, 1978; ED 162 897; 95 pages.

Herbert L. Coon and Mary Lynne Bowman, Energy Activities for the Classroom, Volume II. 1978; ED 173 072; 165 pages.

Mary Lynne Bowman, Values Activities in Environmental Education. 1979; ED 182 118; 134 pages.

Charles E. Roth and Linda G. Lockwood, Strategies and Activities for Using Local Communities as Environmental Education Sites. 1979; ED 194 349; 207 pages.

Mary Lynne Bowman, Teaching Basic Skills through Environmental Education Activities. 1979; ED 196 704; 132 pages.

Mary Lynne Bowman, Teaching Natural Resources Management through Environmental Education Activities. 1981; ED 214 752; 206 pages.

Lori D. Mann and William B. Stapp, Thinking Globally and Acting Locally: Environmental Education Teaching Activities. 1982; ED 229 214; 327 pages.

John F. Disinger and Marylin Lisowski, Teaching about Hazardous and Toxic Materials. 1985; ED 273 432; 268 pages.

John F. Disinger and Marylin Lisowski, Teaching Activities in Science/Society/Technology/Environment. 1986; ED 282 711; 164 pages.

I. INTRODUCTION

Materials containing hazardous substances present serious problems to human health and to the health of the environment. There are many potential problems related to the site of a house or apartment, the construction materials used in the house or the apartment, products and materials used in and around the home, and disposal of materials.

Some effects on humans from household hazardous materials are immediate. Improper use or storage can result in poisoning, physical injury, fire, and explosions. Some health effects are caused by long-term exposure to hazardous materials and are not so obvious. Research data indicate that a number of human health problems such as allergies, cancer, damage to organs and the nervous system, and birth defects may be due to chemical and radiation exposure.

The threat of hazardous materials used in and around the home also present a threat to the environment. Materials that are improperly used around the home can contaminate parts of the environment and can pollute air, water, and soil; in some cases they can have direct effects on plant and animal life.

The disposal of household hazardous wastes can also present environmental problems. Wastes dumped into the drain, storm sewers and drainage systems can pollute rivers, lakes, streams, groundwater and soil. Household hazardous wastes placed in municipal waste collection containers can contaminate landfills and materials that are incinerated; this contamination can cause air, water, and soil pollution and have negative effects on humans and other animals and plant life.

Improper disposal of hazardous materials can also cause damage to household plumbing or septic systems, municipal wastewater collection and treatment systems, and municipal solid waste collection, separation, and disposal systems.

Relatively few compilations of instructional materials related to household hazardous materials have been available until the last five years. This publication was designed to identify problems and concerns that should be included in environmental education programs related to household hazardous material problems and to identify sources of references and instructional materials that can be used for environmental education programs.

Education related to hazardous materials in and around the home should be included throughout the school curriculum and from elementary school through secondary school. Materials to support this philosophy are provided to illustrate activities for science, social studies, and language arts for grades 1-12.

Each of the sections in the manual presents some background information on the problem or topic and materials to illustrate some instructional approaches for various grade levels and courses.

II. WHAT ARE THE CHARACTERISTICS OF HAZARDOUS MATERIALS?

A. Introduction

Hazardous materials are substances that contain chemicals that can harm or kill living things. The chemicals they contain usually have one or more of six characteristics:

(1) Toxicity

These substances are poisonous and harmful to human health and other animals. Some substances can kill (toxic and lethal), cause birth defects (teratogens), affect genetic material (mutagens), and cause cancer (carcinogens). Cadmium, lead, mercury and endrin are examples of materials with toxic activity.

(2) Corrosiveness

These substances can harm human tissue and corrode containers and materials if they are placed on them. Examples include acids and bases and materials containing acids and bases.

(3) Reactiveness

These substances are unstable and may react to heat, shock, water, or air to produce a violent change (explosion) or form poisonous fumes. Examples include gunpowder and some cyanide and sulfide-bearing materials.

(4) Ignitability

These substances can emit gases and explode. Examples include gasoline, solvents, and propane.

(5) Cause Infection and Allergies

Some materials can cause illness and allergies. Examples include bacteria in food and some houseplants and materials brought into the house that may contain bacteria or viruses that can cause infection.

(6) Radioactivity

Some items used in the home may contain small amounts of radioactive material, such as many smoke detectors. Some homesites and water supplies also may have radioactive materials due to natural contamination or human contamination. Radon is a currrent concern as is contamination from mining and industrial plants producing radioactive materials.

Students need to know what materials in or around their homes are hazardous, the type of hazards they present and how toxic the materials are. Materials in this section are designed to help students become aware of these materials and understand characteristics of them.

Listed in Table 2-1 are some substances used in and around the home, examples of hazardous ingredients in them, and potential harmful effects of the hazardous ingredients.

Table 2-1

HOUSEHOLD HAZARDOUS MATERIALS,
INGREDIENTS, AND POTENTIAL HAZARDS

ITEM	KNOWN EXAMPLES OF HAZARDOUS INGREDIENTS	POTENTIAL HAZARDS OF INGREDIENTS
1. AUTOMOTIVE PRODUCTS		
Antifreeze	Ethylene glycol	Very toxic; three ounces can be fatal to adult; damage to cardiovascular system, blood, skin and kidneys.
	Methanol	Moderately toxic; ingestion may cause coma, respiratory damage.
Auto Batteries	Sulfuric acid	Skin burns; single overexposure may lead to laryngeal or pulmonary edema (excess fluid in larynx or lung tissue)
Car Wax, Polish	Petroleum distillates	Associated with skin and lung cancer; irritant to skin, eyes, nose, lungs; entry into lungs may cause fatal pulmonary edema.
Degreasers	Chlorinated aliphatic hydrocarbons	Slow decomposition; trichlorethylene and perchlorethylene are suspected carcinogens; liver and kidney damage.
Engine, Radiator Flush/Cleaner	Chlorinated aliphatic hydrocarbons	Slow decomposition; liver and kidney damage.
	Acids	Corrosive; irritant; damage to kidney, liver and digestive system; pulmonary edema.
Motor Oil/Gasoline	Petroleum hydrocarbons	Highly flammable; associated with skin and lung cancer; irritant to skin, eyes, nose, throat, lungs; pulmonary edema; benzene is a cargcinogen.
	Lead	Damage to digestive, genitourinary, neuromuscular and central nervous system; anemia and brain damage.
Rust Preventers/ Removers	Chlorinated aliphatic hydrocarbons	Slow decomposition; trichloroethylene and perchlorothylene are suspected carcinogens; liver and kidney damage.
	Potassium dichromate	Very toxic; highly corrosive to skin and nervous membranes; if ingested may cause coma, liver damage.

Table 2-1 (Continued)

ITEM	KNOWN EXAMPLES OF HAZARDOUS INGREDIENTS	POTENTIAL HAZARDS OF INGREDIENTS
2. PESTICIDES AND YARD MAINTENANCE		
Herbicides (2,4,D; 2,4,5-T; 2,4,5-TP (Silvex); MCPA, MCPB)	Chlorinated Phenoxys	Contaminated with dioxin, which is deadly and mutagenic; irritation to skin, eyes, throat.
Herbicides (Paraquat, *Diquat)	Dipyridyl	Toxic; causes skin, eyes and throat irritations; causes lung, kidney and liver damage, death.
Herbicides (Dinitrophenol, Dinitroorthocresal, Binapacryl)	Nitrophenols	Highly toxic; readily absorbed via skin; stains skin yellow; interferes with oxygen transfer in cells; damages liver, kidney, nervous system.
Pesticides (Aldocarb, *Oxamyl, Carbofuran, Methyomyl, Sectran, Propoxur, Carbaryl (Sevin)	Carbamates	Interfere with human nervous system.
Pesticides (Endrin, *Aldrin, *Dieldrin, *Toxaphene, *Lindane, Benzene, *Hexachloride, DDT, *Heptachlor, *Chlordane, *Mirex, *Methoxychlor)	Chlorinated hydrocarbons	Very slow biodegradation; accumulation in food chain and in fatty tissue; attack nervous system; suspected carcinogens and mutogens.
Pesticides (Phorate, Mevinphos, *Demetor, *Disulfotan, Parathion, *Diazinon, Trichlorfon, Ronnel, Azinphosmethyl)	Organophosphorus	Poison by interfering with the nervous system; can be toxic; biodegradable, but not much is known about the breakdown products.
Pesticides (Monvran, *Divron, Linvron, Bromacil, Terbacil, Altrazine, Ametryn)	Urea, Uracil, Triazine-based	Low toxicity, but will irritate skin, eyes, throat.
Rodenticides (Warfarin, Coumafuryl, Diphacinone, Pinclone, Valone)	Coumarin	Anticoagulents may cause internal bleeding.

*These pesticides are banned or restricted and should not be used by households.

Table 2-1 (Continued)

ITEM	KNOWN EXAMPLES OF HAZARDOUS INGREDIENTS	POTENTIAL HAZARDS OF INGREDIENTS
3. MAINTENANCE PRODUCTS		
Asphalt/Roofing Tar	Petroleum Solvents	Associated with skin and lung cancer; irritant to skin, eyes, nose, lungs; entry into lung may cause fatal pulmonary edema, excess fluid in lung tissues.
Paints	Aromatic hydrocarbon thinners	Flammable; skin irritant; benzene is a carcinogen; possible liver and kidney damage.
	Mineral spirits	Highly flammable; skin, eyes, nose, throat, lung irritant; very high air concentrations may cause unconsciousness, death.
Paint Thinner	Chlorinated aliphatic hydrocarbons	Slow decomposition; liver and kidney damage.
	Esters	Toxicity varies with specific chemical; causes eye, nose and throat irritation and anesthesia.
	Alcohols	Volatile and flammable; eye, nose and throat irritation.
	Chlorinated aromatic hydrocarbons	Flammable; toxic; accumulate in food chain.
	Ketones	Flammable; toxicity varies with specific chemical; may cause respiratory ailments.
Waterproofers	Chlorinated aliphatic solvents	Slow decomposition; liver and kidney damage.
	Aliphatic and aromatic hydrocarbon solvents	Flammable; irritant, central-nervous system depression; possible liver, kidney, spleen damage.
Wood Preservatives	Chlorinated aromatic hydrocarbons	Flammable; toxic; accumulate in food chain.
	Pentachlorophenol	Pentachlorophenol may be very toxic by ingestion or skin absorption.
	Mineral Spirits	Irritates skin, eyes, throat; absorbed through skin; damages liver, kidneys and nervous system.
Wood Putty	Ketones	Flammable; may cause respiratory ailment.
	Toluene	Flammable; very toxic; may cause skin, kidney, liver, central nervous system damage; suspected carcinogen.

Table 2-1 (Continued)

ITEM	KNOWN EXAMPLES OF HAZARDOUS INGREDIENTS	POTENTIAL HAZARDS OF INGREDIENTS
3. MAINTENANCE PRODUCTS (Continued)		
Wood Stains/ Varnish	Mineral Spirits, gasoline	Highly flammable; associated with skin and lung cancer; irritant to skin, eyes, nose, throat, lungs; entry into lungs may cause fatal pulmonary edema.
	Methyl and ethyl alcohol	Flammable; damage to eyes, skin, central nervous system.
	Benzene	Flammable; carcinogen; accumulates in fat, bone marrow, liver tissues.
	Lead	Damage to digestive, genitourinary, neuromuscular and central nervous system; anemia and brain damage.
Wood Strippers	Chlorinated aliphatic hydrocarbons (methylene chloride)	Slow decomposition; liver and kidney damage.
	Toluene	Flammable; skin irritation; narcotic properties; may damage liver, kidney, central nervous system.
	Benzene	Flammable; carcinogen; accumulates in fat, bone marrow, liver tissue.
4. HOUSEHOLD CLEANERS		
Bleach	Sodium hydrochlorite	Corrosive: irritates or burns skin, eyes, respiratory tract; may cause pulmonary edema or vomiting and coma if ingested; contact with other chemicals may cause chlorine fumes.
Disinfectants	Sodium hydrochlorite	Corrosive: irritates or burn skin, eyes; may cause pulmonary edema, or vomiting and coma if ingested.
	Phenols	Flammable: very toxic; respiratory, circulatory or cardiac damage.
	Ammonia	Vapor irritating to eyes, respiratory tract and skin; possible chronic damage.
Drain Cleaner	Sodium or Potassium hydroxide	Caustic: irritant; inhibits reflexes; burns to skin, eyes; poisonous if swallowed due to severe tissue damage.
	Hydrochloric acid	Corrosive, irritant; damage to kidney, liver and digestive system.
	Trichloroethane	Irritant to nose and eyes; central nervous system depression; liver and kidney damage if ingested.

Table 2-1 (Continued)

ITEM	KNOWN EXAMPLES OF HAZARDOUS INGREDIENTS	POTENTIAL HAZARDS OF INGREDIENTS
4. HOUSEHOLD CLEANERS (Continued)		
Floor Cleaner/Wax	Diethylene Glycol	Toxic; causes central nervous system depression and kidney, liver lesions.
	Petroleum Solvents	Highly flammable; associated with skin and lung cancer; irritant to skin, eyes, nose, throat, lungs.
Furniture Polish	Petroleum distillates or Mineral spirits	Highly flammable; moderately toxic; associated with skin and lung cancer; irritant to skin, eyes, nose, throat, lungs; entry into lungs may cause pulmonary edema.
Metal Polish	Petroleum solvents	Highly flammable; associated with skin and lung cancer; irritant to skin, eyes, nose, throat, and lungs.
	Oxalic acid	Potential damage to respiratory system, lungs, skin, kidneys; skin and eye irritant.
Oven Cleaner	Sodium or potassium hydroxide (lye)	Caustic; irritant; inhibits reflexes; burns to skin, eyes; poisonous if swallowed due to severe tissue damage.
Septic Tank Cleaners	Trichlorethylene	Slow decomposition; known animal carcinogen; kidney, liver and spleen damage.
	Methylene chloride	Slow decomposition; liver and kidney damage.
Silver Cleaner and Polish	Denatured ethanol or isopropronol	Moderately toxic; central nervous depressant.
	Phosphoric acid	Corrosive; irritant; possible damage to kidney, liver and digestive system.
Spot Removers	Perchloroethylene or trichloroethane	Slow decomposition; liver and kidney damage; perchloroethylene is suspected carcinogen.
	Ammonium hydroxide	Corrosive; vapor extremely irritable to skin, eyes, and respiratory passages; ingestion causes tissue burns.
	Sodium hydrochlorite	Corrosive; irritates skin, eyes, respiratory tract; may cause pulmonary edema and skin burns.

Table 2-1 (Continued)

ITEM	KNOWN EXAMPLES OF HAZARDOUS INGREDIENTS	POTENTIAL HAZARDS OF INGREDIENTS
4. HOUSEHOLD CLEANERS (Continued)		
Toilet Bowl Cleaner	Sodium acid sulfate or oxalate or hydrochloric acid	Corrosive; burns from skin contact or inhalation; ingestion may be fatal.
	Chlorinated phenols	Flammable; very toxic; respiratory, circulatory or cardiac damage.
Window Cleaners	Diethylene glycol	Toxic; causes central nervous system depression and degenerative lesions in liver and kidneys.
	Ammonia	Vapor irritating to eyes, respiratory tract and skin; possible chronic irritation.
5. COSMETICS		
Nail Polish	Aromatic hydrocarbon solvents	Flammable; very toxic; skin contact may cause irritation to chemical pneumonitis (lung inflammation); may cause kidney, liver, blood, central nervous system disorders.
	Acetone	Moderately toxic; flammable; may cause respiratory ailments.
	Ethyl and butyl acetate	Moderately toxic; may cause central depression, damage to eyes, skin, respiratory system.
6. PET MAINTENANCE		
Flea Powder	Carbaryl	Very toxic; interferes with human nervous system; may cause skin, respiratory system, cardiovascular system damage.
	Dichlorophene	Skin irritation; may damage liver, kidney, spleen and central nervous system.
	Chlordane and other chlorinated hydrocarbons	Very slow biodegradation; accumulates in food chain; may damage eyes, lungs, liver, kidneys and skin.

Table 2-1 (Continued)

ITEM	KNOWN EXAMPLES OF HAZARDOUS INGREDIENTS	POTENTIAL HAZARDS OF INGREDIENTS
7. OTHER		
Batteries	Mercuric oxide (in mercury batteries)	Ingestion may be fatal.
Inks	Glycols	Toxic; poison by skin absorption, ingestion and sometimes inhalation; eye irritant; stupors; kidney damage.
	Alcohols	Volatile and flammable; methanol is very toxic if swallowed; eye, nose and throat irritation.
	Glycol ethers	Highly flammable.
Mothballs	Chlorinated aromatic hydrocarbons (dichlorobenzene)	Flammable; accumulate in the food chain; vapor irritating to skin, eyes, dichlorobenzene is a suspected carcinogen.
	Napthalene	Possible damage to eyes, blood, liver, kidneys, skin, central nervous system; suspected carcinogen.

Materials used in the home vary from having very little risk to those having substantial, even lethal risk in small amounts. Table 2-2 provides a toxicity rating guide with examples of the toxicity of some household materials.

Table 2-2

HOW SAFE ARE HOUSEHOLD PRODUCTS?*

TOXICITY RATING	LETHAL DOSE FOR 150 lb. HUMAN	HOUSEHOLD PRODUCTS...
1 Practically Non-Toxic	More than 1 Quart	foods, candies
2 Slightly Toxic	1 Pint to 1 Quart	glass cleaner, deodorants and anti-perspirants, hand soap
3 Moderately Toxic	1 Ounce to 1 Pint	antifreeze, automotive cleaners, household bleaches, many detergents, dry cleaners, most floor cleaners, metal cleaners, most oven cleaners, many general cleaners, most fuels, lubricating oils, most stain and spot removers, many disinfectants, floor polish, shoe polish, most paints.
4 Very Toxic	1 Teaspoon to 1 Ounce	most toilet bowl cleaners, some deodorizers, engine motor cleaners, some fertilizers, some paint brush cleaners, some paint and varnish removers, fireworks, some mildew proofing, air sanitizers, some paints, lacquer thinners, many pesticides: DDT, chlordane, heptachlor, lindane, mirex, diazinon, malathion, diquatdibromide, endothall, 2,4D.
5 Extremely Toxic	7 drops to 1 Teaspoon	some of the insecticides, fungicides, rodenticides, herbicides: aldrin, eldrin, bidrin, methyl parathion, paraquat, some fertilizers, mercury cell battery
6 Super Toxic	a taste (less than 7 drops)	a few pesticides like: paroxon, phosdrin, parathion, isobenzan, pyrasoyan

*Adapted from: Gosselin, Robert E. Clinical Toxicology of Commercial Products. Williams and Wilkins, Baltimore, MD. 1984.

B. Selected Activities Regarding Types of Hazardous Materials and Environmental Risks

Activity 1 - Characteristics of Hazardous Substances
Activity 2 - What's Up, Doc?
Activity 3 - Toxic Substances in the Home
Activity 4 - Hazards in the Home - A Household Survey
Activity 5 - Perceptions of Health and Environmental Risks

Activity 1

CHARACTERISTICS OF HAZARDOUS SUBSTANCES

PURPOSE: To define "hazardous" and to provide examples of four major characteristics of hazardous substances.

LEVEL: 10-12

SUBJECT: Science

CONCEPT: To illustrate toxicity, corrosiveness, reactiveness and ignitability.

REFERENCE: Adapted from Llewellyn, Gerald C., et al. The Dilemma of Toxic Materials, Classroom-Tested Ideas and Resources for Social Studies and Science Teachers, Virginia Commonwealth University, Richmond, VA, 1985. ED 263 015.

ACTIVITY: This series of activities is designed to illustrate four characteristics of hazardous substances, toxicity, corrosiveness, reactiveness and ignitability.

Toxicity

Toxicity can cause death in a short time period, usually in less than a week or a month or it can lead to illness and eventually death after months or years. Normally we think of toxicity as acute, causing immediate or near immediate death.

The amount of agent causing death is often related to the time it takes to kill the organism and the number or organisms (%) killed. A commonly used procedure is that of determining the LD_{50}, lethal dose to 50% of the organisms. Also the LC_{50}, lethal concentration which the organisms live in that will cause 50% of them to die. The latter is usually associated with fish and aquatic organisms. For the LD_{50}, the amount of toxin is usually considered in relation to the mg of toxin administered or fed to an organism based on its body weight in kg. Since few test organisms weigh one kg, proportional calculations are applied to the amount of toxin that is required to kill 50%, yet toxic amounts are usually reported in mg/kg of organism.

a. Illustration of toxicity

Photographs from magazines, slides, newspaper articles, and films of dead animals, plants, or fish kills can be used to illustrate effects of toxic substances.

b. Activities illustrating toxicity

1. Effect of herbicides on plants

Plant 15 grass seeds (rye grass or blue-grass will do) in tray 1 and 15 grass seeds in tray 2. Space the seeds about one inch apart.

Plant 15 seeds of a broad-leaf plant (beans, peas, dandelion) in tray 3 and 15 seeds of a broad-leaf plant in tray 4.

After the plants have grown at least three inches high, place the trays outside in the sun. Spray all the plants in tray 1 and 4 with a weed herbicide for lawns at the recommended rate. Read the label for instructions, take care in handling the herbicide, and put a sign on the trays that they have been treated with herbicide.

Continue watering and observe and record the results for at least 10 days. Discuss the results.

What would happen to plants if a lawn weed herbicide were used in a garden?

What would be the potential danger to humans if herbicides were used close to a garden or in a garden?

2. Effect of substances on fruit flies

1) Obtain two 500 ml flasks.
2) Place 15 fruit flies, a piece of banana, and a plain cotton ball in one flask. Place a thin cotton wad in the top of the flask.
3) Place 15 fruit flies, a piece of banana, and a cotton ball that has been placed in finger nail polish remover in the second flask. Place a thin cotton wad in the top of the flask.
4) Observe the flasks after 15 minutes, 30 minutes, and 24 hours and record the results.
5) Discuss.

Corrosiveness

a. Illustrations of corrosion

Photographs of corrosion can be shown to illustrate effects on metals, humans and other animals, and organic materials.

b. Activities illustrating corrosiveness

1. Teacher demonstrations

(a) Place a plain iron (steel, non-coated, non-galvanized) nail into a 10% solution of copper sulfate (10g/100 ml water). Observe after 20 minutes. Observe again after 24 hours.

(b) Place a small ball of steel wool in water. Then place it on a paper towel. Observe for the next 48 hours. Explain what you observed.
(c) Care should be taken in handling acids. Use gloves, aprons, and goggles. Place about 150 ml of dilute acid (HCl or H_2SO_4) in a glass container with a small amount (about 10 gm) of mossy zinc. Observe. Place the container aside for 24 hours and observe again. After 48 hours observe again. Explain what you observed.
(d) Care should be taken in handling bases. Use gloves, aprons, and goggles. Place about 150 ml of dilute sodium hydroxide (NaOH) in a container. Add some pieces of fabric (rayon, wool, and cotton). Observe 24 hours and 48 hours later. Explain what you observed.

Reactiveness

a. Illustration of reactivity

Obtain a film or videotape to illustrate reactivity. These visual aids are more effective than pictures or slides. Most local fire departments frequently will provide visual materials.

b. Activities illustrating reactivity

1. Action of pressure and heat on a substance

Obtain a roll or sheet of caps used in a cap gun.

(a) Place a cap on a metal surface away from students and paper. Hit the cap with a hammer. Discuss what happened.
(b) Place several caps on a small sheet of paper placed on a metal surface. Ignite the paper with a match. Discuss what happened.
(c) Discuss what occurred and safety concerns related to the observation.

2. Action of heat with materials

Obtain a small tank of propane or butane fuel as commonly used for outdoor cook stores. Attach the burner unit (like a bunsen burner) to the tank.

Use a match to ignite the gas.

Discuss what material is in the tank. Consider safety in the storage and use of the tank and its contents. Consider safety in the disposal of the tank.

3. Action of heat with materials

Obtain a camera with a flash unit and expendable flash bulbs (bulbs that are used up after a flash). Press the camera button to cause the bulb to flash (do not point it directly at people nor hold at a close distance toward people). After the flash, examine the bulb. What did you observe? Was the bulb warm after the flash? How are flash bulbs constructed? Why?

Are there any materials used in the home that could have similar reactions?

Activity 2
WHAT'S UP, DOC?

PURPOSE: To illustrate that toxic substances can have adverse effects on humans.

LEVEL: 7-12

SUBJECT: Science, Health

CONCEPT: Toxic substances contain some chemicals that when inhaled, injested, absorbed, or injected into the body in sufficient amounts can cause reversible or irreversible damage.

REFERENCE: Adapted from Bags, Beakers, and Barrels...An Action Curriculum toward Resolving Hazardous Materials Issues. For Middle and High School Students. Industrial States Policy Center, Columbus, OH, 1987. ED 313 216.

ACTIVITY:

TEACHER PREPARATION:

1. By using the ailments listed from the fictitious people and the information on toxic chemicals and their health effects, students will understand the potential severity of some chemicals in our environment. This activity may be made more challenging by splitting Handout 2A into two pages, and giving each student only one half. This will necessitate high quality communication to solve the puzzles.
2. Duplicate Handouts 2A and 2B.
3. If your class would like a more challenging activity, cut Handout 2A in half, crosswise.
4. Review the Teacher Background section if you need more information.

CLASS ACTIVITY:

1. Divide the class into small groups, or pairs, or ask the class to form small groups.
2. Distribute Handouts 2A and 2B, challenge the students to determine what is "wrong" with each patient in Handout 2B. They may use clues from the workplace and the patient's symptoms.
3. Every person in each group must agree on the diagnosis.
4. Suggested answers to the patient symptom scenarios are as follows: 1. Asbestos, 2. Hydrogen Sulfide, 3. Cadmium, 4. Benzene, 5. Mercury.
5. When the groups have finished, lead a discussion to see if all the groups agree and explore any of the following discussion questions.
   - Why do so many chemicals damage the liver? What is the function of the liver?
   - For each of the symptoms given, discuss if it is chronic or an acute effect of an exposure.
   - What is the difference between a mutagen, teratogen, and carcinogen? Could one chemical be all three?

FOLLOW-UP:

1. Invite students to explore the health effects of toxic chemicals in more detail. What toxic chemicals are most common in your community?
2. Contact local unions from manufacturing industries and request that a health and safety representative come to speak to the class regarding health problems workers have experienced and the measures which have been taken to provide protection.

TEACHER BACKGROUND MATERIAL ON TOXICITY

A toxic chemical is defined as any chemical that when inhaled, injested, absorbed, or injected into the body in sufficient amounts has a noxious effect on the body - reversible or irreversible. Toxic effects may also arise as the side effects in response to some medications, vaccines, and exposure to chemicals.

Toxicity: is the ability of a chemical substance to produce harm or injury to a living organism when the chemical has reached a sufficient concentration. The chemical injury may be local or systemic.

Local Injury: is injury that results from direct contact of the chemical with tissue. This chemical can irritate the skin, eyes and the lungs.

Systemic Injury: is injury from a substance that affects the body tissue after absorption into the bloodstream. A material cannot produce injury unless it gains entry into the body. Common routes of entry are ingestion, injection, skin absorption and inhalation. A chemical which causes systemic injury generally enters by one of these routes and then enters the bloodstream, where it may cause general effects or critical injury to specific tissues or organs.

Threshold limit value (TLV): is the estimate of the average safe toxicant concentration that can be tolerated on a repetitive basis, for an eight hour period on a day to day basis. A sufficiently small amount of most chemicals produces no injury or "no effect."

All chemicals do not follow the same exact pathway through the body. Some chemicals primarily damage the central nervous system and others may damage the liver. Toxics can also be described as carcinogens, mutagens, and teratogens.

Carcinogen: is any agent that produces and/or accelerates the development of malignant tumors or abnormal growth of cells.

Mutagen: is an agent that affects the DNA so that it may produce cancer or a mutation in a future generation. People who work with a certain chemical may not be hurt by it, but their offspring may be. Radiation is a mutagen that has been associated with sterility.

Teratogen: is an agent that interferes with normal embryonic development. Chemicals given to a pregnant animal may produce birth defects without damaging the mother.

STUDENT HANDOUT 2A

HEALTH EFFECTS DATA SHEET

What Parts of the Body Are Affected?

Arsenic
Liver, skin and lung cancer
Greatest threat from inhalation

Asbestos
Lung and intestinal cancer
Asbestosis
A fiber that damages lungs when breathed by irritating the fragile tissue

Benzene
Leukemia
Central Nervous System Disorders: headaches, nausea, unconsciousness
Is rapidly absorbed by the blood system where it causes damage

Cadmium
Kidney damage
Bone brittling
Accumulates in the body and food chain

Hydrogen Sulfide
Respiratory track damage
Central Nervous System Damage: headaches, nausea, blurred vision, absorbed by blood stream when inhaled

Mercury
Brain damage
Absorbed through intestinal track, carried by blood stream when inhaled

Trichloroethylene
Liver and lung cancer
Loss of nerve sensations
Skin irritant

Vinyl Chloride
Liver and kidney cancer
Central Nervous System disturbance, Dermatitis
Reproductive Effects

Which Workplaces?

Metal Refining (Copper, Lead, Zinc, etc.)
Arsenic
Cadmium
Platinum (compound)

Textile Industry
Arsenic
Asbestos
Benzidine

Metal Finishing
Cadmium
Platinum

Construction Industry
Benzene
Trichloroethylene
Asbestos

Chemical Industry & Plastics
Benzene
Hydrogen Sulfide
Tricholorethylene
Vinyl Chloride

Paper Industry
Hydrogen Sulfide
Benzidine

Pesticides/Fertilizer
Cadmium
Arsenic
Mercury

Fossil Fuels (burning & production)
Arsenic
Benzene

STUDENT HANDOUT 2B

PATIENT SYMPTOMS

1. Sam has been a construction worker for ten years. His primary job is removing old insulation in the buildings his company remodels. Lately, he has noticed that he has difficulty breathing, both shortness of breath and chest pain. What might be the cause of his ailment? List the clue(s) which helped you determine the potential cause.

2. In a freak accident at the Clean Sheet Paper Company, a cloud of toxic gas rolled across the local community. Most people reacted by coughing, but many of the elderly became quite sick. What might have been the chemical gas? Why do you suppose the elderly were severely affected?

3. Maria is a fisherman's wife. Her father was a fisherman, and her children probably will be. For most of her life she's lived with the clean, salt spray of the ocean. During her last visit to the local clinic, Maria discovered her kidneys do not function properly, and she wonders how she could have been exposed to a toxic chemical. Can you tell her? What types of industries would you expect to find in the area? If she lives in a rather rural area, what might you suspect caused her kidney problems?

4. An entire family is complaining of nausea, frequent colds, tiredness, and stomach cramps. They live on a farm in a rural area. No matter which way the wind blows, there is always a funny smell in their house. The farm one mile away has been sold to someone who is collecting barrels and drums. What might be bothering the family? What are the likely routes of exposure?

5. In the late 1700's, beaver pelt hats were the rage in Europe. The beaver furs were treated with a mercury compound during the processing, before they were sewn into hats. From where did the saying "mad as a hatter" come or the Alice in Wonderland character?

For each case described above, list a few protective measures that might have been taken by the people or the industry to prevent the exposure.

Activity 3

TOXIC SUBSTANCES IN THE HOME

PURPOSE: To demonstrate that common household products must be safely used and stored, or they will present threats to health.

LEVEL: K-3

SUBJECTS: Science
Health
Fine Arts

CONCEPT: Pollutants and contaminants are produced by natural and man-made processes.

REFERENCE: Purin, Gina, editor. Toxics in My Home? You Bet! Curriculum on Household Toxics for Grades 4-6. Sacramento, CA: Golden Empire Health Planning Center, 1984, pp. 40-45. ED 266 949.

ACTIVITY: Materials Needed:

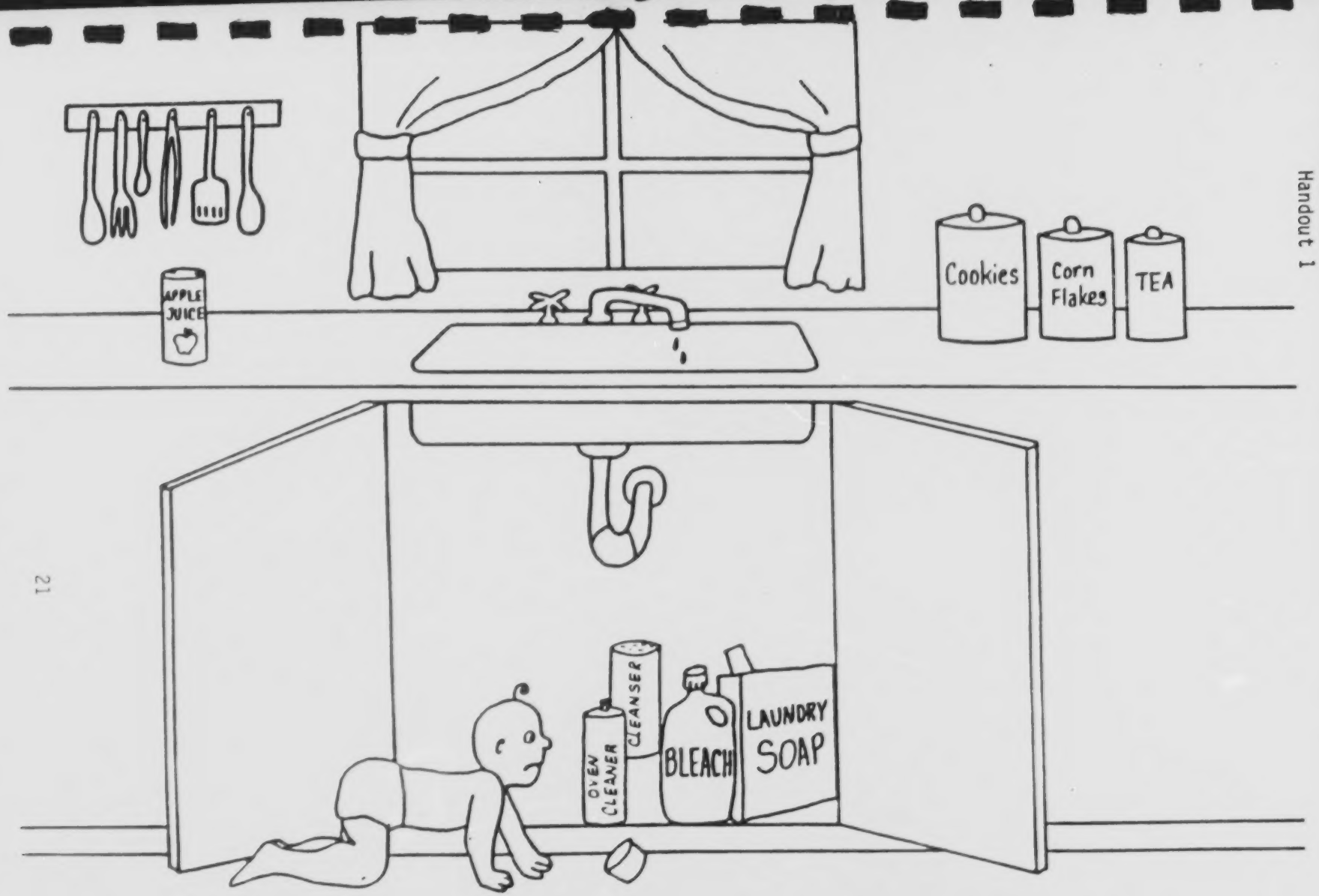
1. Coloring handouts
2. Crayons
3. Construction paper or plain white sheets of 8 1/2" x 11" paper.

Activity 1:

Each handout should be discussed and the information on the page read orally. Handouts could be colored later or at home. Hand out the handouts to each child.

Handout 1 - Discuss what is safe and what is dangerous for a baby to eat in the kitchen. Ask the children how a baby might get hurt by the household cleaners. (EXAMPLES: a baby might be thirsty and drink bleach and get sick; a baby might spray oven cleaner in his/her eye and it will burn.) Have the children put an X on the cleaners. Discuss ways to keep a baby away from cleaners (e.g., lock the cupboard doors, put the cleaners on a high shelf, keep the cleaners in the garage on a high shelf). Read the information on handout 1 aloud. Color.

Handout 2 - Discuss how weed and bug sprays are poisons and can make people and pets sick. (EXAMPLES: Children playing around gardens being sprayed might get sprayed themselves. They could get sick. Animals might get sick when they eat weeds and grass containing pesticide residues.) There are directions on all poisons that tell how the product should be used. The directions should be followed very carefully. Read the information on handout 2 aloud. Color.



Handout 1

21

Put an X on household products the baby should not eat.
Lock cupboards. Keep children away from dangerous products.

Handout 2

31 Weed poison is dangerous. Stay away from poisoned areas.
Put an X on the weed killer. 32

Handout 3 - Similar to handout 2. Snail killer is a poison. Discuss how snail killer can make people and pets sick. (EXAMPLES: Children and pets could get sick by eating the pellets.) Read the information on handout 3 aloud. Color.

Handout 4 - Discuss how products kept in the bathroom are not safe to eat. (EXAMPLE: Some children think things are safe to eat and drink if they look pretty or smell good. Some poisons look pretty and smell good and could make us very sick if we eat or drink them. We should never eat or drink something unless we are sure of what it is.) Ask for suggestions on keeping bathroom supplies away from small children. Read the information on handout 4 aloud. Color.

EVALUATION: Discuss completed handouts. Through oral questions, determine if the children understand the message on each page.

Direct the students to take the handouts home and read the handouts with their parents.

Snail killer is poison. Put an X on the box of snail killer.
Keep poisons away from children and pets.

Keep all bathroom products out of the reach of children.
Put an X on the products that the baby can reach.

Activity 4

HAZARDS IN THE HOME - A HOUSEHOLD SURVEY

PURPOSE: To identify hazardous materials that are found in the home.
LEVEL: 7-9; can be modified to use at other grades.
SUBJECT: Science
CONCEPT: Many materials used in and around contain hazardous materials and require care in use, storage, and disposal.
REFERENCES: Adapted from activities submitted by several teachers and USEPA reference materials.
ACTIVITY: Distribute the inventory forms to the students. Have each student work with a parent or parent(s) to complete the inventory at home.

Have each student answer the following questions:

1. What are the most common hazardous materials in your home?
2. Which of the hazardous materials are used the most?
3. Which of the hazardous materials are used the least? How are they stored?
4. Do you have any younger brothers or sisters? If yes, what precautions have been taken to protect them from the hazardous materials? (Examples: locked cabinet, locked room, stored at a level they can't reach, care in use, etc.)
5. What are the most toxic materials in your home?

Have the class share information to answer the following questions.

1. What are the most common hazards found in most homes? Share information and compile total for the class.
2. If other classes found similar results to those of this class, (a) what materials present the most common problems in your community? (b) what materials present the most common hazards in the home for young children? (c) what materials present the most common storage problems?

Household Inventory of Potential Hazards

Directions: Do a survey of your house to find materials that are potentially hazardous. Count the number of containers and place it on the line. Total each category.

NUMBER OF PRODUCTS	TOXIC	REACTIVE	IGNITABLE	CORROSIVE	CONTAINERS IN MY HOME
CLEANERS					
Ammonia	X				
Bleach	X			X	
Disinfectant	X			X	
Window Cleaner	X				
Drain Cleaner	X			X	
Oven Cleaner	X			X	
All-Purpose Cl.	X			X	
Rug & Upholstery Cl.	X			X	
Furniture Polish & Wax	X				
Brass Polish	X			X	
Silver Polish	X		X	X	
Spot Cleaner/Remover	X		X		
					Total____
COSMETICS					
Nail Polish Remover	X		X		
Hair Dye	X				
Hair Spray	X		X		
					Total____
AUTOMOTIVE PRODUCTS					
Wax & Polish	X		X		
Antifreeze	X				
Gasoline/Kerosene	X		X		
Motor Oil	X				
Engine Degreaser	X				
Car Battery	X			X	
					Total____
PESTICIDES					
Mothballs	X				
Rodent Poison	X				
Ant, Wasp, Roach Spray	X				
Slug Bait	X				
Insecticide	X				
Herbicide/Fungicide	X				
Flea Powder/Spray	X				
					Total____

PRODUCTS	TOXIC	REACTIVE	IGNITABLE	CORROSIVE	NUMBER OF CONTAINERS IN MY HOME
HOBBY SUPPLIES					
Ammunition		X	X		
Photo Chemicals	X				
Chemistry Set	X	X	X	X	
					Total____
PAINTS/PRESERVATIVES					
Paint	X		X		
Solvent/Thinner	X		X		
Drier	X		X		
Wood Preservative	X		X		
Stripper	X		X		
					Total____
MEDICINES					
	X				
					Total____
OTHER					
					Total____

Activity 5

PERCEPTIONS OF HEALTH AND ENVIRONMENTAL RISKS

PURPOSE: To understand that perceptions of risk depend upon available information, knowledge of problems, and media emphasis.

LEVEL: 10-12; can be modified to use at lower grade levels

SUBJECTS: Science, Health

CONCEPT: Environmental problems can be ranked based on cancer risks, noncancer health risks, ecological risks, and welfare risks.

REFERENCES: Adapted from USEPA references and Allen, Frederick W. "Towards a Holistic Appreciation of Risk: The Challenge for Communicators and Policymakers," Science, Technology, and Human Values, p. 138-43, Summer/Fall, 1987.

ACTIVITY: Tables 2-3 and 2-4 present information regarding (1) an EPA Task Force's ranking of environmental problems and (2) rankings on environmental problems by the public.

1. Discuss the problems and their rankings by the EPA Task Force. Especially note those that relate to the home.

2. Have the students answer the following questions:

   (1) Compare the rankings by the public in 1984-86 to those of the EPA Task Force. How do they differ? (pesticides, indoor air pollution, consumer product exposure, worker exposure to chemicals, and global warming ranked lower by the public).
   (2) Why do you believe that they differ? (Public lacks some information experts have; some of the other problems had received more mass media exposure).
   (3) Do you believe public attitudes toward any problems have changed on those ranked lower in 1984-86? If yes, which ones?
   (4) Why have home-related problems usually been lower ranked by the public than by experts? (People are frequently affected more over time rather than immediately by these problems; when problems do occur in the home they usually only affect a few people in the house at one time; most of the effects of these problems are not on the news as they occur).

Table 2-3

RECENT RANKINGS OF SELECTED ENVIRONMENTAL PROBLEMS

BY AN EPA TASK FORCE

1. Problems that ranked relatively high in cancer and noncancer health risks but low in ecological and welfare risks include:
    a. Hazardous/toxic air pollutants
    b. Indoor radon
    c. Indoor air pollution other than radon
    d. Drinking water as it arrives at the tap
    e. Pesticide application
    f. Exposure to consumer products
    g. Worker exposures to chemicals

2. Problems that ranked relatively high in ecological and welfare risk, but low in both health risks include:
    a. Global warming
    b. Point and nonpoint sources of surface water
    c. Pollution
    d. Physical alteration of aquatic habitats (including estuaries and wetlands)
    e. Mining waste

3. Problems related to ground water consistently ranked medium or low, principally,
    a. Active hazardous sites
    b. Inactive hazardous waste sites
    c. Municipal nonhazardous waste sites
    d. Industrial nonhazardous waste sites
    e. Underground storage tanks

4. Other major categories of environmental problems that received generally mixed and/or medium/low rankings included:
    a. Contaminated sludge
    b. Mining waste
    c. Accidental releases - toxic chemicals
    d. Accidental releases - oil spills
    e. New toxic chemicals
    f. Biotechnology (environmental releases of genetically altered materials)

5. Problems that ranked relatively high in three of four risk types, or at least medium in all four include:
    a. Criteria air pollutants from mobile and stationary sources (includes acid precipitation)
    b. Stratospheric ozone depletion
    c. Pesticide residues on food
    d. Runoff and air deposition of pesticides ("other" pesticide risks)

* Modified from Allen, Frederick W. "Towards a Holistic Appreciation of Risk: The Challenge for Communicators and Policymakers," Science, Technology, and Human Values, p. 138-43, Summer/Fall, 1987.

Table 2-4

COMPARISONS OF PUBLIC OPINIONS
(1984-86 ROPER POLLS)
AND EPA TASK FORCE PROBLEM AREAS *

Public Perception of Risk and Ranking		Roper Area	Corresponding EPA Environmental Problem Area
High	1.	Chemical waste disposal	Hazardous waste sites - active Hazardous waste sites - inactive
	2.	Water pollution	Direct point source discharges Indirect point source discharges Nonpoint source discharges
	3.	Chemical plant accidents	Accidental releases - toxics
	4.	Air pollution	Criteria air pollutants Hazardous air pollutants
Moderate	5.	Oil tanker spillings	Accidental releases - oil spills
	6.	Exposure on the job	Worker exposure
	7.	Eating pesticide-sprayed food	Pesticide residues on foods
	8.	Pesticides in farming	Application of pesticides "Other" pesticide risks
Lower	9.	Drinking water	Drinking water
	10.	Indoor air pollution	Indoor air pollution
	11.	Indoor air pollution	Consumer product exposure
	12.	Genetic engineering	Biotechnology
	13.	Strip mining	Mining waste
	14.	Non-nuclear radiation	Radiation - other than radon
	15.	The "greenhouse" effect	CO_2 and global warming

Note: Adequate information was not available from Roper to rank the following EPA problem areas: "other" air pollutants; radon - indoor air; stratospheric ozone depletion; contaminated sludge; estuaries, coastal waters, and oceans; wetlands; nonhazardous waste sites - municipal; nonhazardous waste sites - industrial; releases from storage tanks; "other" groundwater contamination; and new toxic chemicals.

* Allen, Frederick W. "Towards a Holistic Appreciation of Risk: The Challenge for Communicators and Policymakers," Science, Technology, and Human Values, p. 138-43, Summer/Fall, 1987.

III. WHAT ARE POTENTIAL PROBLEMS RELATED TO THE HOMESITE OR HOME CONSTRUCTION?

A. Introduction

There are several potential environmental problems due to the site of a house or apartment. Among the most common problems are (1) air pollution from surrounding areas (above ground), (2) noise pollution from surrounding areas, (3) electromagnetic pollution from power transmission lines, (4) radon escaping into the home, (5) contaminated drinking water in rural areas, (6) contaminated drinking water from a utility due to poor water sources or delivery system, (7) chemical contamination of the soil, (8) sewage disposal problems, and (9) problems due to flooding.

There can also be several environmental problems in a home due to the way a home is constructed and the materials used in the home.

This section of the publication presents information and activities that focus on environmental problems related to the home site and home construction.

B. Activities related to the Homesite and Home Construction

Activity 1 - Homesite Environmental Survey
Activity 2 - Home Construction Environmental Inventory
Activity 3 - Reducing Pollution in the Home Due to the Homesite and Home Construction

Activity 1

HOME SITE ENVIRONMENTAL SURVEY

PURPOSE: To identify potential environmental problems related to the site of a house or apartment.

LEVEL: 7-12; the activity could be modified to use at lower grade levels.

SUBJECT: Science, Health, Industrial Technology

CONCEPT: Health hazards in the home can be created by environmental conditions around and under a building.

REFERENCE: Adapted from activities suggested by several teachers.

ACTIVITY: All home sites should be given a health audit. The audit should be designed to include the air, ground, underground material, water, and drainage.

The following inventory should be used to check each student's home site. Inform the parents that the students will be doing the activity at home and encourage them to participate.

1. Have students complete their home inventories.

2. After completing the home inventory have each of the students answer the following questions:
   a. Which environmental problems did you find currently existing at your home site?
   b. What can be done to minimize two of these problems?
   c. What are potential environmental problems at your home site?
   d. What can be done to prevent or to reduce these potential problems?

3. After the students have completed their inventories and questions, have the class share information, tabulate the data, and discuss the data.
   a. What were the most common problems found at home sites?
   b. Which problems need to be solved by people living in the home and which require community action?
   c. What are the most common potential problems?
   d. How can they be prevented or reduced?

HOMESITE ENVIRONMENTAL SURVEY

Complete each of the following items related to the homesite.

1. Air

   a. Is there chemical air pollution?
   _____Yes _____No _____Don't Know
   If yes, what is the type and extent of the air pollution?
   _____
   _____
   _____
   If no, are there any sites close by that could be used for purposes that would create air pollution (industry, highway, etc.)?
   _____
   _____
   _____

   b. Is there noise pollution?
   _____Yes _____No _____Don't Know
   If yes, what is the type and extent of the noise pollution?
   _____
   _____
   _____
   If no, are there any plans or spaces likely to be used for purposes that would create noise pollution?
   _____
   _____
   _____

   c. Is there electromagnetic pollution?
   _____Yes _____No _____Don't Know
   If yes, what is the type and extent of electromagnetic pollution?_____
   _____
   _____
   _____
   If no, are there any plans or spaces likely to be used for purposes that would create electromagnetic pollution?
   _____
   _____
   _____

2. Ground Material

   a. Has the ground been tested for chemical pollution?
   _____Yes _____No _____Don't Know
   If yes, what were the results?_____
   _____
   _____
   _____

If no, how was the ground used before the structure was built?_____

b. Has the ground been tested for radon?
_____Yes _____No _____Don't Know
If yes, results?_____

If no, is the subsoil and rock structure likely to produce radon?_____

c. Does water drain toward the homesite?
_____Yes _____No
If yes, are there any possible sources of pollution that would contaminate the drainage?_____

3. Water Source

a. What is the water source?
_____Municipality
_____Utility (Private)
_____Well

b. Has the water supply been tested for adequate flow?
_____Yes _____No _____Don't Know
If yes, is the supply constant and sufficient?

c. Has the water supply been tested for contaminants?
_____Yes _____No _____Don't Know
If yes, what were the results?_____

If no, check the legal requirements for your area regarding the water supply and testing.

d. If you have well water, can any developments occur that will alter your water supply? _____Yes _____No _____Don't Know
If yes, what might occur?_____

Activity 2

HOME CONSTRUCTION ENVIRONMENTAL INVENTORY

PURPOSE: To identify potential environmental problems related to materials used in construction of a home and the way the home is constructed.

LEVEL: 7-12; the activity could be modified to use at lower grade levels

SUBJECT: Science, Health, Industrial Technology

CONCEPT: Health hazards in the home can be created by materials used in the construction of a home and the way a home is constructed.

REFERENCE: Adapted from activities suggested by several teachers.

ACTIVITY: All homes should be given a health audit. The audit should be designed to cover all aspects of the construction, finishing, and furnishing of the home.

The following inventory should be used to check each student's home. Inform the parents that the students will be doing the activity at home and encourage them to participate.

1. Have students complete their home inventories.

2. After completing the home inventory have each of the students answer the following questions.

   a. Which environmental problems did you find currently existing in your home?
   b. What can be done to minimize two of these problems?
   c. What potential environmental problems exist in your home?
   d. What can be done to determine if two of these are actual problems?

3. After the students have completed their inventories and questions, have the class share information, tabulate the data, and discuss the data.

   a. What were the most common problems found in the homes?
   b. Which problems do you believe are most serious? How can residents solve these problems? Do renters and home owners have different problems in solving problems related to construction? Finishing? Furnishings?
   c. What could the community do to help reduce problems due to

      (1) Construction and finishing?
      (2) Furnishings?

HOME CONSTRUCTION ENVIRONMENTAL SURVEY

Check each of the following related to the home or apartment.

1. Foundation and substructure

   a. Does the home have a basement, cement slab, or crawl space?
   b. If the home has a basement has the basement been tested for radon?
   c. If the home is built on a cement slab has the first floor been tested for radon?
   d. If the home has a crawl space has the crawl space been checked for radon and pesticides?

2. Construction (walls, finishes, floors, ceilings)

   a. What type of insulation has been used in the walls and ceilings? Is there any potential hazard from the insulation?
   b. What type of plywood or pressed wood has been used in the house? (Floors, walls, ceilings) Is there any danger from environmental hazards?
   c. What type of material has been used to cover the floors (padding, tile, rugs, coatings)? Is there any danger from environmental hazards?

3. Mechanical Systems

   a. Plumbing (Water Supply)

      1) What is the source of the water? Is it adequate? Is it safe?
      2) What type of plumbing (pipes) are used in the house? Do they contain lead (solder)? Are they plastic?
      3) Does the plumbing have proper cross-connections to prevent contamination of water in the house?

   b. Heating

      1) If the heat source involves combustion, is the heat source vented properly to the outside?
      2) If the heat source involves combustion, has the heat source been checked to determine if it is functioning properly and not emitting carbon monoxide within the house?
      3) Have chimneys been checked to be certain they are functioning properly?
      4) If insulation is used for the heating system is it properly wrapped to prevent fibers from getting into the air?
      5) If the home has central heating and cooling, are there filters on the air distribution system? Are the filters cleaned regularly?

c. Electrical

1) Has the electrical system been checked to determine that wires are not overloaded?
2) Has the electrical system been checked to determine that wires are well insulated and not worn?

4. Furnishings (Padding, Rugs, Curtains, Furniture, Applicances, Fireplaces, Stoves)

a. Do any of the furnishings create environmental hazards (Odor from chemicals in materials and finishes; lack of venting; improper placement; create particulates in the air)?

Activity 3

REDUCING POLLUTION IN THE HOME DUE TO THE HOMESITE AND HOME CONSTRUCTION

PURPOSE: To identify environmental problems related to homesite and home construction and ways of preventing, eliminating, or reducing them.

LEVEL: 7-12; the activity could be modified for use at lower grades.

SUBJECT: Science, Health, Industrial Technology

CONCEPT: Health hazards in the home due to homesite, home construction and home furnishings can be prevented and/or reduced.

REFERENCE: Adapted from activities suggested by several teachers.

ACTIVITY: 1. Preventing and reducing respirable suspended particulates.

a. Background information

What are respirable suspended particulates?

Suspended particulates are small particles that are produced by combustion, construction, and various other processes in the house.

How can suspended particulates affect you?

While the most common effect of suspended particulates is irritation of the eyes, nose, and throat, they also contribute to lung cancer, emphysema, heart disease, bronchitis, and respiratory infections.

How do suspended particulates get into the home?

Most particulates that get into the home are produced in the home, though outside air can provide pollutants as well. Common sources of suspended particulates are tobacco smoke, wood stove smoke, fireplaces, unvented gas appliances, kerosene heaters, asbestos and other insulation materials, construction, household hobbies, and house dust.

How can suspended particulates be reduced?

Several procedures can be used to reduce particulates. Included are the following:

1) Eliminate tobacco smoking in the home;
2) Vent all combustible materials to the outside;
3) Cover all units involving combustion such as fireplaces and heaters so that fumes and ashes do not enter the room. Enclosed stoves are normally more efficient than fireplaces and also allow less particulate material to enter the home.

4) Remove ashes from combustion in closed containers.
5) Cover all insulation and other similar material so that particles can not enter the household air.
6) Increase household ventilation.
7) Do activities that create particulates such as carpentry, sanding, soldering, welding and paint stripping outside to reduce particulates in the house.
8) Install an air filter if you have a central heating and/or cooling system. Several varieties are available including fabric filters and electrostatic filters.
9) Obtain a vacuum cleaner that captures fine particles. Most vacuum cleaners do not remove fine particles.

b. Student Activities

1) Does your home have any of the potential sources of particulates identified in this section? If yes, which ones?
2) If you have any of the potential sources, identify what your family has done to reduce particulates from entering the air in the home and what your family could do to further reduce particulates.
3) Suggested alternative activities

a) Conduct library research to determine the effectiveness of different types of air filters for central heating and cooling systems.
b) Conduct library research to determine the effectiveness of different types of vacuum cleaners. How effective are most household vacuum cleaners for removing small particules?
c) Contact your local health department to determine what they recommend regarding reducing suspended particulates in household air.
d) If you live in an area where industrial plants, wood burning stoves and fireplaces and vehicles produce airborne particulates, determine what your state and community are doing to reduce the particulates.

2. Preventing and Reducing Radon in Your Home

a. Background Information

What is radon?*

Radon is a radioactive gas which occurs in nature. You cannot see it, smell it, or taste it.

Radon comes from the natural breakdown (radioactive decay) of uranium. Radon can be found in high concentrations in soils and rocks containing uranium, granite, shale, phosphate, and pitchblende. Radon may also be found in soils contaminated with certain types of industrial wastes, such as the byproducts from uranium or phosphate mining. Radon is extremely unreactive; however, two alpha-emitting isotopes are solids and can become trapped in the body where their radioactivity can damage cells.

In outdoor air, radon is diluted to low concentrations. Inside an enclosed space (such as a home) radon can accumulate. Indoor levels depend both on a building's construction and the concentration of radon in the underlying soil.

How can radon affect you?

The only known health effect associated with exposure to elevated levels of radon is an increased risk of developing lung cancer. Not everyone exposed to elevated levels of radon will develop lung cancer, and the time between exposure and the onset of the disease may be many years. Scientists estimate that from about 5,000 to about 20,000 lung cancer deaths a year in the United States may be attributed to radon.

Your risk of developing lung cancer from exposure to radon depends upon the concentration of radon and the length of time you are exposed. Exposure to a slightly elevated radon level for a long time may present a greater risk of developing lung cancer than exposure to a significantly elevated level for a short time. In general your risk increases as the level of radon and the length of exposure increase.

*Much of the material has been adapted from several USEPA publications.

How does radon get into a home?

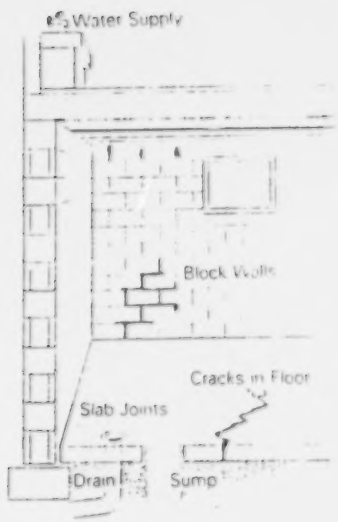
Radon can seep into a home through dirt floors, cracks in concrete floors and walls, floor drains, sumps, joints, and tiny cracks or pores in hollow-block walls.

Radon can also enter water within private wells and be released into a home when the water is used. Usually radon is not a problem with large community water supplies, where it would likely be released into the outside air before the water reaches a home. In some unusual situations, radon may be released from the materials used in the construction of a home.

Figure 1 indicates common entry points of radon in homes and other buildings.

Figure 1

COMMON RADON ENTRY POINTS



How can radon be detected?

Since you cannot see or smell radon, special equipment is needed to detect it. The two most popular commercially-available radon detectors are the charcoal canister and the alpha track detector. Both of these devices are exposed to the air in your home for a specified period of time and sent to a laboratory for analysis. Alpha track detectors that are exposed for one month or more, are more sensitive and accurate than charcoal cannisters.

Homeowners in some areas are being provided with detectors by their state or local governments. Some retail stores sell detection devices and private firms offer testing.

How should a home be checked for radon?

Usually the best approach to determine if you have a potential problem is to check the location of the highest probable reading. The lowest area in which people live (the basement if you have one) will usually provide the highest reading.

Obtain a detector and follow the instructions on the detector. Highest results are usually obtained during cool months of the year when windows are closed and central heating is in use.

Results are usually reported in picocuries per liter (pci/l). If your screening result was below 4 pci/l, you probably do not have a problem that can be reduced very much. If you have results of 20 to 200 pci/l, you should have a professional check your home within a few months. If your reading is between 4 and 20 pci/l, you should have your home checked by a professional as soon as convenient, but within a year.

Table 3-1 presents data that provides an estimate of the risk due to exposure to radon.

Table 3-1

RADON RISK EVALUATION CHART*
(Risk from a Lifetime of Exposure)

PCi/l	Estimated number of lung cancer deaths due to radon exposure (out of 1000)	Comparable exposure levels	Comparable Risk
200	440-770	1000 times average outdoor	More than 60 times non-smoker risk 4 packs a-day smoker
100	270-630	100 times average indoor level	200 chest x-rays per year
40	120-380		2 packs a-day smoker
20	60-210	100 times average outdoor level	
			1 pack a day smoker
10	30-120	10 times average indoor level	
			5 times non-smoker risk
4	13-50		
2	7-30	10 times average outdoor level	200 chest x-rays per year
1	3-13	Average indoor level	non-smoker risk of dying from lung cancer
0.2	1-3	Average outdoor level	20 chest x-rays per year

*USEPA

Current techniques do not measure all radon potentially present, but most estimates indicate they account for all but 20-30 percent of the daughter cells.

How Can the Radon Risk Be Reduced?

There are several procedures that can be used to reduce risks due to radon if it is present. The two main techniques are to (1) prevent entrance of radon into a building and (2) dilute the inside air with outside air.

Table 3-2 provides a list of methods that can be used to reduce radon, the cost of the technique, and the effectiveness of the technique.

Table 3-2

COMPARISON OF PROCEDURES FOR REDUCING RADON* **

Method	Installation Cost	Operating Cost	Maximum Possible Reductions*	Comments
Natural ventilation:				Useful immediate step to reduce high radon levels.
Basement or lowest floor	Minimal	High to very high	Up to 90+%	
Crawl space	Minimal	Moderate	Up to 90+%	
Forced ventilation:				More controlled than natural ventilation.
Basement or lowest floor	Low to moderate	Very high	Up to 90+%	
Crawl space	Low to moderate	Moderate	Up to 90+%	
Heat recovery ventilation				Air intake and exhaust must be equal. Also, expect lower radon reductions for houses with moderate to high air exchange rates.
Ducted	Moderate to high	Low to moderate	50-75%	
Wall mounted	Low to moderate	Low to moderate	No data available	
Covering exposed earth	Moderate to high	Low	Site specific	Required to make most other methods work.
Sealing cracks and openings	Minimal to high	Nominal	Site specific	Required to make most other methods work.
Drain-tile suction	Moderate to high	Low	Up to 99+%	Works best when drain is continuous, unblocked loop.
Sub-slab suction	High	Low	Up to 99+%	Works best with good aggregate or highly permeable soil under slab.
Block-wall ventilation	High	Low	Up to 99+%	Applies to block-wall basements. Sub-slab suction may be needed to supplement.
Prevention of house depressurization	Low to moderate	Low	Site specific	May be required to make other methods work. May see seasonal impact.
House pressurization	Moderate to high	Moderate	Up to 90% (limited data)	Most cost-effective when basement is tightly sealed.

*These represent generally the best reductions that a single method can accomplish. You may get higher or lower reductions depending on the unique characteristics of your house. It is likely that reductions in your house will not be as great as those shown. Especially with high initial radon levels, several methods may have to be combined to achieve acceptable results.

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b. Student Activities

1. Has your home been checked for radon?
_____Yes ____No
If yes, what were the results?
If no, do other homes in your area have radon readings that are higher than the recommended level?

2. Suggested Alternative Activities

a) Conduct library research to determine the incidence of radon in your state.
b) Conduct library research on the types of soils, subsoils, and rock associated with radon. Compare these to those that occur in your area.
c) Contact your local health department to determine local regulations regarding radon and incidence of radon.
d) Contact the local building and contractors association to determine what they do in new construction to reduce radon problems.
e) Contact the local building and contractors association to determine how much activity they have in reducing radon in homes and what techniques they most frequently use.

3. Preventing and Reducing Formaldehyde in the Air in Your Home.

a. Background Information

What is formaldehyde?

Formaldehyde is a chemical that forms a colorless, pungent-smelling water soluble gas.

How can formaldehyde affect you?

Formaldehyde can cause watery eyes, burning sensations in the eyes and throat, headaches, nausea, memory loss, dizziness, nose-bleeds, and difficulty in breathing. High concentrations can induce asthmatic attacks and some people develop chemical sensitivity to it and are affected by even small amounts. Formaldehyde has been shown to cause cancer in animals and may cause cancer in humans.

How does formaldehyde get in the home?

Sources of formaldehyde in the home include cigarette smoke, household products (air fresheners, nail polish, eye make-up), pressed wood products (particleboard, plywood, fiberboard), urea-formaldehyde insulation, some paints, glue, some synthetic fibers used in clothing, draperies, carpeting, and furniture, and combustion from unvented gas or kerosene heaters.

The release of formaldehyde is normally high when the product is new and decreases over time. High indoor temperature and humidity increases the release of formaldehyde in a gaseous form.

How can formaldehyde in the air be decreased?

Several procedures can be used to reduce formaldehyde in the air. Included are the following:

1) Eliminate tobacco smoking in the home.
2) Vent all gas and kerosene heaters to the outside.
3) Check the formaldehyde content of all building materials used in the home.
4) Check the products used in the home, especially carpets, furniture, air fresheners, and coatings for formaldehyde content.
5) Maintain moderate temperature and humidity levels.
6) Maintain a proper ventilation level of the house.
7) Do not burn materials containing formaldehyde in an open fireplace.

b. Student Activities

1) Does your home have any of the sources of formaldehyde identified in this section?
_____Yes _____No
If yes, which ones?
2) Has your family made plans to control formaldehyde in the air in your home? _____Yes _____No
If yes, discuss.

c. Class Activities

1) Collect sources found in the home by individual students and determine the most common problems.
   a) Which problems would be the easiest to prevent or reduce?
   b) What do you recommend should be done?

4. Preventing and Reducing Carbon Monoxide and Nitrogen Oxides

a. Background Information

What are carbon monoxide and nitrogen oxides?

Carbon monoxide is a colorless, odorless tasteless gas produced by burning fuels. Nitrogen oxides are colorless and tasteless gases generated by burning gas and kerosene.

How can carbon monoxide and nitrogen oxides affect you?

Carbon monoxide affects the lungs, the brain, and vision. It can be fatal in high concentrations. Nitrogen oxides can cause lung damage and lower body resistance.

How do carbon monoxides and nitorgen oxides get into the home?

Carbon monoxide in the home usually comes from incomplete burning of wood, kerosene, gas or oil. Sources include old and malfunctioning furnaces, gas water heaters, gas ovens, wood stoves, kerosene heaters, blocked chimneys, barbecue grills, and cars (when started and run in an attached garage).

Nitrogen oxides are most frequently generated by kerosene heaters and unvented gas stoves.
An unattached garage or building in which any of these items are used can have similar problems.

How can carbon monoxide and nitrogen oxides be reduced?

Several procedures can be used to reduce carbon monoxide and nitrogen oxides in the home. Included are the following:

1) Vent all furnaces, stoves, and heaters to the outdoors.
2) Have furnaces, stoves, and heaters inspected and adjusted on a regular basis to be certain they are operating properly.
Inspect all chimneys on a regular basis to be certain they are not leaking.
4) Do not run a car engine in a closed garage.
5) Be certain all chimneys are of the proper heighth and away from windows.
6) If you have a tightly sealed home and use gas or wood for fuel, consider installing a monitor to check for emissions.

b. Student Activities

1) Does your home have any of the sources of carbon monoxide and nitrogen oxides identified in this section? _____Yes _____No
If yes, which ones?
2) Has your family made plans to control these gases in the home? _____Yes _____No
If yes, discuss.

Toxic materials if present in sufficient amounts can cause damage to human organs and to the nervous system. Pesticides, fertilizers, lead, chromium, and mercury are examples of materials that can cause damage to humans in even relatively low concentrations.

Some materials in water such as iron and sulfur, if present in sufficient amounts, can also cause staining of plumbing and clothes.

How can contaminants in water be reduced?

Several procedures can be followed to reduce contamination of water.

1) If you have a municipal water supply:

   a) Request results of tests on the water and treated water to determine the quality of the source and the effectiveness of the treatment. A good water system has quality water sources and effective treatment.
   b) Request information on the quality of the treated water as delivered to homes. A good water supply delivers quality water to the home.
   c) Check the plumbing in your home to determine if you have good pipes (do not have lead present) and have good connections. Also check the quality of the water from your hot water heater.

2) If you have a well

   a) Be sure the water has been tested.
   b) Determine the source of the water and take actions to be sure that it does not become contaminated.
   c) Treat the water if needed to assure quality water.
   d) Check plumbing as for homes that have municipal supplies.

b. Student Activities

1) Check the color and odor of your water. Is there any color or odor? ____Yes ____No If yes, check the reason for this.
2) Have students determine the source of their water. What are potential contaminants from the source?
3) Have students check their plumbing at home

   a) Do pipes contain lead?
   b) Do they have lead solder in the pipes?
   c) Do they have proper cross-connections in pipes to prevent back flow of water in the home?

c. Class Activities

1) Discuss results of the student activities.
2) Have teams prepare reports on trends in water supply, water treatment, water quality, and health in your area.
3) Discuss what needs to be done to maintain and/or improve conditions reported in 2 above.

IV. WHAT ARE POTENTIAL PROBLEMS RELATED TO MATERIALS USED IN AND AROUND THE HOME?

A. Introduction

Students need to be aware of materials used in and around the home. They should also be aware of hazards associated with the use of specific materials, how to shop to avoid purchasing extremely hazardous products, substitutes available for hazardous products, wise use of hazardous products, ways of storing hazardous products, and proper disposal of hazardous products and containers.

This section and the following section contain information and activities to help the student learn about potential problems and how to prevent or reduce them.

Table 4-1 lists many of the common items used in or around the home that present possible hazards. Possible hazards, precautions, and substitutes are listed.

The most common problems for humans in handling toxic materials are due to inhaling substances into the lungs, getting materials in their eyes, absorbing materials through the skin, and getting materials into the mouth.

Tables 4-2 and 4-3 suggest ways to protect the skin and equipment to use (masks or respirators) to use to protect from inhaling materials. The skin can also be protected by wearing proper clothing and washing immediately after using products.

Some materials also present combustion problems. Table 4-4 presents information on types of fire extinguishers to use with types of fires. Precautions should be taken to have specific types of fire equipment available when storing or using household hazardous materials that might be involved in a fire.

Eyes can be protected by wearing proper goggles and ingesting materials can be prevented or reduced by washing after using materials, using materials away from food, and proper clean up.

Table 4-1

HOUSEHOLD HAZARDOUS MATERIALS,
POSSIBLE HAZARDS, PRECAUTIONS, AND SUBSTITUTES*

ITEM	POSSIBLE HAZARDS	PRECAUTIONS AND SUBSTITUTES
1. AUTOMOTIVE PRODUCTS		
Antifreeze	Very poisonous Has sweet taste - attractive to small children and pets.	Clean up any leaks or spills carefully. No substitutes
Batteries	Contain strong acid. Very corrosive. Danger to eyes and skin.	Trade in old batteries. No substitutes
Waxes and polisnes	Fumes irritating to eyes. Harmful if swallowed Eye and skin irritant.	Use outside. No substitutes
Degreasers	Corrosive. Poisonous. Eye and skin irritant.	Instead: choose strong detergent type over solvent type.
Motor oil and transmission fluid	Poisonous. May be contaminated with lead and other toxic substances. Skin and eye irritant.	No substitutes
2. PESTICIDES AND YARD MAINTENANCE		
Insecticides, herbicides, fungicides, slugbait, rodent poison, wood preservatives	All are dangerous to some degree. Can cause central nervous system damage, kidney and liver damage, birth defects, internal bleeding, eye injury. Some are readily absorbed through the skin.	Do not buy more than you need. Instead: try hand-picking, mechanical cultivation, natural predators. Practice good sanitation. Choose hardy varieties. Use insect lures and traps. As a last resort, use least toxic suitable pesticides.

*Information was compiled from several sources. A major source was Home Safe Home: An Educational Open House. Western Washington Toxics Coalition, Seattle, WA.

Table 4-1 (Continued)

ITEM	POSSIBLE HAZARDS	PRECAUTIONS AND SUBSTITUTES
3. HOME MAINTENANCE PRODUCTS		
Asphalt roofing compound	Eye irritant. Fumes moderately toxic	Do not use indoors. No substitutes
Paints	Flammable. Skin irritant. Possible damage to organs from solvents and metals.	Use water-based paints when possible. Use with good ventilation. Avoid paints with heavy metals.
Varnishes	Eye and skin irritant. Use in small, closed area may cause unconsciousness.	Do not use near open flame. May take weeks for fumes to go away. Instead: use water-based paints if possible.
Paint strippers, thinners, and other solvents	Many are flammable. Eye and skin irritant. Moderately to very poisonous.	Avoid aerosols. Buy only as much as you need. Ventilate area well. Do not use near open flame. Instead of paint stripper: sand or use heat gun. Use water-based clean-up products as much as possible.
Lacquer and lacquer thinner	Extremely flammable. Very poisonous.	Ventilate area very well. Do not use in room with pilot light, open flame, electric motors, spark-generating equipment, etc. DO NOT SMOKE WHILE USING. No substitutes
Insect and pest sprays	All are poisonous, some extremely so. May cause damage to kidneys, or central nervous system. Toxicity varies from product to product.	Instead: do not attract insects: keep all food securely covered, practice good sanitation in kitchen and bathrooms, remove trash every night.

Table 4-1 (Continued)

ITEM	POSSIBLE HAZARDS	PRECAUTIONS AND SUBSTITUTES
4. HOUSEHOLD CLEANERS		
Bleach: chlorine	Fumes irritate eyes. Corrosive to eyes and skin. Poisonous if swallowed.	NEVER mix with ammonia or strong acids like toilet bowl cleaner or rust remover! Instead: use Borax, non-chlorine bleach, sunlight, lemon juice.
Disinfectants	Eye and skin irritant. Fumes irritating. Poisonous if swallowed	Some may contain bleach, others ammonia - DO NOT MIX! Instead: use detergent cleaners whenever possible.
Drain cleaners	Very corrosive. May be fatal if swallowed. Contact with eyes can cause blindness.	Prevention best: keep sink strainers in good condition. Instead: use plunger, plumber's snake, vinegar and baking soda followed by boiling water.
Detergent cleaners	All are corrosive to some degree. Eye irritant.	Liquid dishwashing detergent is mildest, laundry detergent is moderate, automatic dishwasher detergent is harshest. Instead: use the mildest product suitable for your needs.
Wood cleaners, polishes, and waxes	Fumes irritating to eyes. Product harmful if swallowed. Eye and skin irritant. Petroleum types are flammable.	Do not use aerosols. Use only in well-ventilated areas. Instead: use lemon oil or beeswax.
Metal polishes	May be flammable. Mildly to very poisonous.	Use only in well-ventilated areas. Instead: substitute vinegar and salt or use baking soda on damp sponge.
Oven cleaner	Corrosive. Very harmful if swallowed. Irritating vapors. Can damage eyes.	Do not use aerosols, which can explode and are difficult to control. Instead: use paste. Or heat oven to 200 degrees, turn off, leave small dish of ammonia in oven overnight and remove, then wipe oven with damp cloth and baking soda. Do not put baking soda on heating elements.

Table 4-1 (Continued)

ITEM	POSSIBLE HAZARDS	PRECAUTIONS AND SUBSTITUTES
4. HOUSEHOLD CLEANERS (Continued)		
Toilet bowl cleaner	Corrosive. May be fatal if swallowed.	Ventilate room. Instead: use ordinary cleanser or detergent and baking soda.
Window cleaner	Vapor may be irritating. Slightly poisonous.	Ventilate room. Instead: spray on vinegar, then wipe dry with newsprint.
5. COSMETICS		
Cosmetics, dandruff shampoos, nail polish	May contain carcinogens. May cause organ damage. May cause allergic reactions.	Check labels for ingredients. Avoid use of items containing hazardous substances.
6. PET MAINTENANCE		
Flea powders, sprays and shampoos	Moderately to very poisonous.	DO NOT USE DOG PRODUCTS ON CATS. Vacuum house regularly and thoroughly. Launder pet bedding frequently.
7. OTHER		
Medicines: unneeded or expired	Frequently cause child poisonings.	Check content of medicine chest regularly. Old med.cations may lose their effectiveness, but not necessarily their toxicity. No substitutes.
Mothballs	Some are flammable. Eye and skin irritant, poisonous, may cause anemia in some individuals.	Do not use in living areas. Air out clothing and other items before use. Clean items before storage. Instead: use cedar shavings or aromatics.
Aerosol containers	When sprayed, contents are broken into particles small enough to be inhaled.	Store in cool place. Propoellant may be flammable. Instead: use non-aerosol products.

Table 4-2

SKIN EXPOSURE PROTECTION - SUGGESTED PROTECTIVE GLOVES FOR HOUSEHOLD PRODUCTS

TOXIC PRODUCT:	TYPE OF GLOVE: Natural Rubber or Latex	Neoprene Rubber	Latex/ Neoprene	Butyl Rubber	Buna-N or NBR Rubber	Nitrile	Polyvinyl Chloride
Adhesives and cements					+	+	
Ammonia	+	+	+	+	+	+	+
Battery acid		+	+	+			
Bleaches		+				+	+
Degreasing solution						+	+
Detergents	+	+	+	+	+	+	+
Disinfectants/deodorizers	+	+	+	+	+	+	+
Drain cleaners		+	+		+	+	
Fertilizers	+	+	+	+	+	+	+
Furniture polish		+	+		+	+	
Gasoline/motor oil/ transmission fluid					+	+	+
General purpose cleaners	+	+	+	+	+	+	+
Insect killers		+				+	
Lacquer thinner					+		
Metal polishes		+	+		+	+	
Oven cleaners		+	+		+	+	
Paints: oil based			+			+	
Paints: water based -- acrylics, latex, lucite	+	+	+	+	+	+	+
Paint and varnish remover						+	
Paint thinner		+	+		+	+	
Photographic solutions	+	+				+	+
Scouring powder	+	+	+	+	+	+	+
Spot removers						+	
Tar (asphalt and roofing)		+	+		+	+	
Toilet bowl cleaners	+	+				+	+
Turpentine		+	+		+	+	
Upholstery, rug and carpet cleaner (powder)		+	+		+	+	
Weed killers	+	+				+	+
Wood filler and putty					+	+	
Wood preservative		+				+	+

Table 4-3

CARTRIDGE AND FILTERS FOR RESPIRATORS

Substance or process protected against	Cartridge		Filters
Aerosol spray paints	Organic vapor	and	Paint spray filter
Air brushing (waterbased materials)			Paint spray filter
Ammonia and amine vapors	Ammonia		
Brazing			Dusts, mists and fumes
Dusts: wood, stone, pigment clay, fiber, shell, bone, toxic			Dusts or dusts and mists
Dyes, enamels, cutting fiberglass, or glazes			Dusts or dusts and mists
Formaldehyde	Organic vapor		
Glazes, or enamel spraying			Dusts and mists
Hydrofluoric acid	Acid gas		
Hydrogen chloride	Acid gas		
Lacquers and fixatives (if sprayed)	Organic vapor	and	Paint spray filter
Lacquer thinners	Organic vapor		
Leather dyes	Organic vapor		
Metal casting			Dusts, mists and fumes
Metal fumes from oxyacetylene welding			Dusts, mists and fumes
Molds, sand or metal powder			Dusts or dusts and mists
Paint strippers	Organic vapor		
Pesticide sprays	Organic vapor	and	Pesticide/Paint spray prefilter
Photo-printmaking solvents	Organic vapor		
Plastics sanding, grinding, cutting	Organic vapor	and	Dusts or dusts and mists
Plastic cements and plastic resins	Organic vapor		
Polyvinyl chloride sanding and grinding	Acid gas	and	Dusts
Silk screen wash-ups	Organic vapor		
Soldering			Dusts, mists and fumes
Solvents	Organic vapor		
Spray adhesives	Organic vapor	and	Paint spray filter
Spraying toxic water-based materials			Dusts and mists
Spraying water-based paints and dyes			Paint spray
Spray mist containing organic solvents	Organic vapor	and	Paint spray or dusts and mists
Sulfur dioxide	Acid gas		

Table 4-4

FIRE EXTINGUISHERS TO USE WITH TYPES OF FIRES

Fire extinguishers are rated for their ability to extinguish fires and these ratings are listed on each one. Look for the "A", "B", "C" rating on the label.

Class of Fire	Type of Fire	Water Solution	Carbon Dioxide	Dry Chemical	Dry Powder
A	Fires caused by ordinary combustibles such as wood, paper, textiles.	Recommended.	Use for small fires only. Follow up with with water.	Use only multi-purpose dry chemical.	Not recommended.
B	Fires caused by flammable liquids and gases, including oil, paint, grease and solvents.	Use foam type only. Do not use with water immiscible solvents such as acetone and alcohol.	Recommended.	Recommended.	Not recommended.
C	Electrical fires.	Not recommended.	Recommended.	Recommended	Not recommended.

B. Activities for Learning about Potential Sources of Indoor Pollution, Hazardous Materials, and Hazardous Wastes and Ways to Reduce Their Danger

Activity 1 - Product Selection Patterns

Activity 2 - Adverse Health Effects of Household Toxics

Activity 3 - Labeling Practices

Activity 4 - Taste Not, Touch Not

Activity 5 - Alternative Materials for Household Toxics: Household Cleaners

Activity 6 - Benefits and Problems Related to Household Products

Activity 7 - Substitutes and Alternatives

Activity 8 - Pesticides: Blessing or Curse?

Activity 9 - Read the Label

Activity 1

PRODUCT SELECTION PATTERNS

PURPOSE: To identify variables that influence product selection patterns.

LEVEL: 10-12

SUBJECT: Social Studies, Consumer Education, Home Economics, Health

CONCEPT: In many cases, alternative procedures or substitute materials may be used to avoid problems inherent in the use and/or disposal of hazardous and toxic substances.

REFERENCE: Purin, Gina, editor. Toxics in My Home? You Bet! Curriculum on Household Toxics for Grades 9-12. Sacramento, CA: Golden Empire Health Planning Center, 1984, pp. 67-73. ED 266 951.

ACTIVITY:

1. Suggest to the students that much of our lifestyle in the 1980's has been built around the use of easy-to-use convenience products. Many of these products contain some potentially hazardous ingredients.

2. Ask, "What influences people to start using these products?" (Write the questions and answers on the board.)

Possible Answers:

Parents have used them; relatives and friends use and/or recommend them; see it in stores; use at work; exposed to advertisements in magazines, on radio, and/or television.

3. Ask, "What reasons do advertisers give for using some of these products?" (Write the question and answers on the board.)

Possible Answers:

Convenient; quick; "new and improved"; effective; easy; social acceptance (stops ring around the collar, stops itchy dandruff, smells good, etc.)

4. Say, "Let's look at some of these advertisements." (Activity to be performed alone or in groups.)

Hand out magazines, scissors, glue, and worksheet. Have the students complete the following activity. Allow 20 minutes.

a. Find one ad which has a potentially harmful effect.
b. Cut out the ad.
c. Paste it on the worksheet.
d. Write under the advertisement:

- the potential harm;
- reason the ad writer is giving for persuading you to buy the product;

- how you think one can avoid or reduce the potential hazards associated with this product (when you use it); and
- the name of a less toxic substitute, if possible.

5. When time is up, have each student (or group) pin their work on a bulletin board or place it somewhere around the classroom. Have the students discuss their posters by:

   a. telling the potential hazards associated with the product;
   b. identifying the advertising gimmick (i.e., why should you buy it, what will the product do, etc.);
   c. stating how potential harm can be reduced when using the product; and
   d. identifying a safer substitute, if possible.

   Encourage participation from the rest of the class.

6. Ask students if they think consumers can influence what products are manufactured.

   Ask students to give examples of how consumer "buying power" influenced the manufacture of products.

   One of the most obvious examples involves the health food industry. Once a small time operation, their products are now in competition with large industries who are now profiting by marketing products they once refused to manufacture. Not too long ago, preservatives in bread was the norm, stone-ground whole wheat was virtually unheard of and herbal teas were self-made concoctions. Today, preservative free bread, wholewheat products and herbal teas are packaged and sold by leading food industries who recognized the growing demand for such foods.

   If we want less toxic products placed on the market and if we want to know the potential acute and chronic health effects associated with the ingredients used in consumer products, we can:

   a. notify the manufacturer and elected officials of our interest and encourage others to do the same; and
   b. start buying less toxic products (if a market is created, manufacturers will respond).

   If we want to continue using products containing toxic chemicals, we should use them with utmost care.

7. Alternative products.

   Ask the students to identify alternative products for those products they believe are needed but that (1) are toxic and present potential harm or (2) create disposal problems.

WORKSHEET FOR ANALYSIS OF ADVERTISEMENT

(Paste Advertisement Here)

Potential harm of product

Reason for persuading you to buy the product

How can one avoid or reduce the potential hazards associated with this product when it is used?

What is a less toxic substitute?

Activity 2

ADVERSE HEALTH EFFECTS OF HOUSEHOLD TOXICS

PURPOSE: To identify adverse health effects associated with specific chemicals.

LEVEL: 7-9

SUBJECT: Health, Science

CONCEPT: In many cases, alternative procedures or substitute materials may be used to avoid problems inherent in the use and/or disposal of hazardous and toxic substances.

REFERENCE: Purin, Gina, editor. Toxics in My Home? You Bet! Curriculum on Household Toxics for Grades 7-8. Sacramento, CA: Golden Empire Health Planning Center, 1984, pp. 16-23. ED 266 950.

ACTIVITY: 1. Tell the students that they will learn to identify, pronounce and list adverse health effects of some chemicals commonly found in home and garden products. Although there are many potentially dangerous chemicals in household products, only a few will be covered in this lesson.

2. Tell the students that although product labels, through use of signal words, can give us a clue to the product's potential hazard, it is often difficult to judge a product's hazard by looking at the product ingredients. Some chemicals are called different names by different manufacturers. For example, toluene and toluol are the same chemical. Unless you are skilled at chemical identification, it can be difficult to truly know what you are buying.

Some products list toxic ingredients that only contribute to immediate health risks. Toxic chemicals associated with long term health hazards may not be listed on the product label.

We should use home and garden products with extreme care and try to reduce or avoid exposure to them whenever possible. Two ways of reducing or avoiding exposure involve: (1) buying less toxic or non-toxic products to replace household toxicants; and (2) taking precautions when using household toxics. Tell the students that later they will learn about safer alternatives to using products containing potentially toxic ingredients. This lesson will cover precautions that can be taken to reduce exposure to toxics when using them.

3. Direct the student's attention to the "Products and Precautions" information sheet. Review and discuss the PRECAUTIONS listed. Students should be aware of the reasons for taking precautions.

4. Have the students take out the Household Toxics Dictionary and the Toxic Substances Worksheet. Have the students read the directions on the worksheet and ask if there are any questions. If time permits, discuss the definitions in the Household Toxics Dictionary.

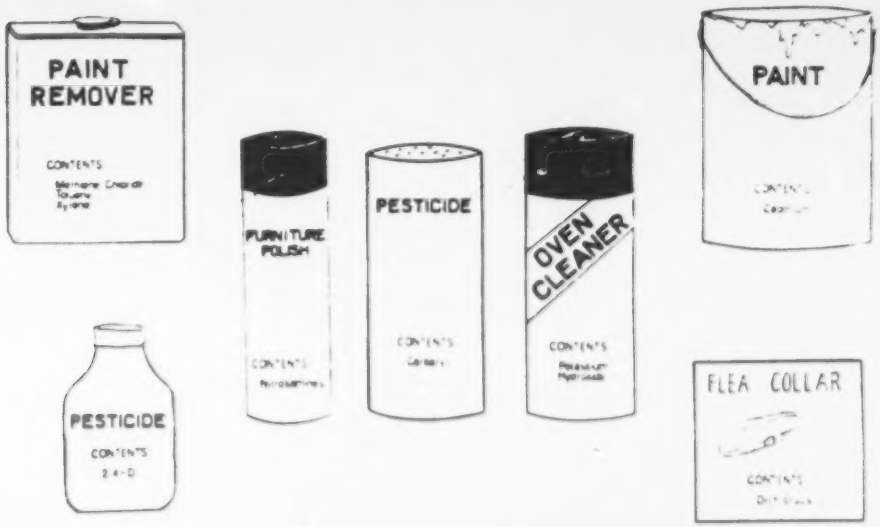
5. Have the students complete the worksheet. Allow 20 minutes. Use this time to duplicate the worksheet on the chalkboard.

6. When the time is up, discuss the students' answers to the worksheet. List their answers on the chalkboard. Discuss why students responded the way they did to the "How to Reduce Exposure" section of the worksheet. Encourage as many students as possible to give their responses.

Using the words listed in the Household Toxics Dictionary, have the students design a crossword puzzle or word search. On a separate piece of paper, an answer sheet should also be developed. When students complete their own puzzle or word search, they can then trade with other students.

PRODUCTS AND PRECAUTIONS

(Chemicals potentially found in a few household products.)



PRECAUTIONS
(How to Reduce Exposure)

- Use in well-ventilated area.
- Avoid use of aerosols whenever possible.
- Keep products out of reach of children and pets.
- Clean up after use.
- Wear protective clothing (e.g., long sleeve shirts, heavy shoes, long pants, gloves).
- Never mix products.
- Use only the recommended amount.
- Keep products in original containers.
- Buy only what you need.
- Others? _____

_____

TOXIC SUBSTANCES MINI-DICTIONARY

The health effects listed in this dictionary are mainly focused on long term effects. This is to alert you to the potential dangers of some chemicals and the necessity for using and disposing of household toxics safely. The complete impact that a chemical may have on a person's health is not known. Also, little is known about the synergistic effects of many chemicals--that is, the effects produced when a chemical acts in combination with other chemicals. Sometimes the effect produced can be more toxic than the effects produced when the chemical acts alone.

It is important to realize that people react differently to different chemicals--some people don't even realize that their illness may be the result of exposure to chemicals in household products. For example, the headache or lightheadedness you may feel several hours after cleaning the house may be the result of inhaling toxic fumes from inadequate ventilation or from the mixing of incompatible chemicals.

Animals are generally used to determine the health effects of chemicals. Many scientists now agree that some human health effects can be predicted from animal studies.

2,4-D
Causes liver and kidney damage in animals. May cause convulsions and dermatitis in humans.

cadmium (kád mē um)
Carcinogen. Causes kidney damage. Respiratory irritant.

carbaryl (kär bär il)
Suspected animal carcinogen.

chlordane (klor dān)
Suspected carcinogen. Causes kidney damage. Mostly affects the central nervous system, causing irritability, tremors, or convulsions.

corrosive (kor rō siv)
To eat into or wear away gradually.

dichlorvos (dī klor vōs)
Possible carcinogen. May cause gene damage.

jaundice (jän dis)
A condition in which the eyeballs, skin and urine become abnormally yellow.

ā as in ate ä as in car ē as in me

methylene chloride (meth i lēn klor īde)
Suspected carcinogen. Causes liver and kidney damage in animals.

nitrosamines (nī trōs i mēns)
Potent cancer causing agent in animals. Can cause liver damage, jaundice, and fever.

potassium hydroxide (pō tas ē um hī drox īde)
Extremely corrosive to all body tissues.

potent (pō tent)
Powerful

toluene (täl yoo wēn)
Possible reproductive hazard. Skin, eye and respiratory irritant.

ventilate (ven tlāt)
To circulate fresh air through a room.

xylene (zī lēn)
Possible reproductive hazard (birth defects). Liver and kidney damage have been observed. Can cause dermatitis (inflammation of the skin).

ī as in file ō as in home

TOXIC SUBSTANCES WORKSHEET

DIRECTIONS: Pick three products from the pictures shown on the Products and Precautions Information Sheet. Using the Mini-Dictionary, look up the health effects for the chemicals found in the products you choose. An example is given below. It is not necessary to list all the health effects given in the Mini-Dictionary. Under the column marked "How to Reduce Exposure," list two appropriate ways of reducing exposure to the chemical. The Products and Precautions Information sheet can assist you.

Product	Toxic Substance Contained in Product	Health Effects	How to Reduce Exposure
Example:			1. Avoid breathing the fumes
Paint Remover	toluene	Possible reproductive hazard.	2. Wear protective clothing

LABELING PRACTICES

PURPOSE: To identify proper labeling practices concerning potentially harmful and potentially toxic household products.

LEVEL: 10-12

SUBJECT: Health, Home Economics, Science

CONCEPT: Pollutants and contaminants are produced by natural and man-made processes.

REFERENCE: Adapted from Purin, Gina, editor. Toxics in My Home? You Bet! Curriculum on Household Toxics for Grades 9-12. Sacramento, CA: Golden Empire Health Planning Center, 1984, pp. 19-21. ED 266 951.

ACTIVITY: Divide class into groups of approximately four to six students. Hand out two sample labels and a worksheet to each group. Make certain that each group has a household product label. EXCLUDE PESTICIDES IN THIS EXERCISE.

After the worksheets have been completed, allow time for presentation of information and discussion of results. Do students think that the labels contain enough information to ensure or encourage safe use and disposal by consumers? Why? Why not? As a homework assignment, have the students examine how the worksheet labels compare with products of a similar nature found in their homes or in local stores.

WHAT'S IN THIS STUFF?

Worksheet

Read: Use the sample label provided to answer the following questions.

1. What is the product name? _____

2. What is the intended use for the product? _____

_____

Read the following information if your product is a household product other than a pesticide. Be aware that disinfectants are considered pesticides.

HOUSEHOLD PRODUCTS (Excluding Pesticides)

NOTE: When manufacturers list ingredients, the information may be confusing. Many chemicals are known by several different names. For example, toluene and toluol; and, aromatic naphtha and naphthalene are different names for the same chemical. Ingredient listings may also be presented in vague or general terms. For example, ingredients may be listed as "grease cutter," "corrosion inhibitor," "polishing agent," "coloring agent," "petroleum distillate," "aromatic hydrocarbon," or other vague terms.

1. List any general or vague terms that appear on the product label.

_____

2. List any warnings or precautions given. _____

_____

_____

3. Are there any indications that this product is toxic or hazardous?

_____

_____

_____

4. List any of the above requirements that appear on the product label.

_____

_____

_____

NOTE: Some products are not required to list product ingredients. This does not mean that potentially toxic ingredients are absent from the product. Rather, it simply implies that substances in the product are not considered to cause an immediate (acute) adverse reaction. Toxic chemicals may be present in a consumer product (without conforming to labeling practices) if the chemical falls below reporting requirements. For example, methyl alcohol used in quantities of less than 4% does not require labeling. Used in quantities of 4% and above, labeling is required. Methyl alcohol can cause blindness if ingested.

5. Can you think of consumer products that have no (or very vague) ingredient listings? If not, check your home or grocery store shelves for such products. _____

_____

_____

The Hazardous Substances Act is the federal law that establishes labeling requirements for consumer products containing hazardous ingredients (except pesticides). The law, enforced by the Consumer Product Safety Commission, also grants the Commission the power to ban substances posing such an extreme hazard that adequate labeling cannot be written. Carbon tetrachloride, for instance, was banned in 1970 for use as a household chemical (such as drycleaning agent, solvent, or glue) when it was found to cause liver and other body damage. Not many substances have been banned. Usually, the label or package is required to be changed to reflect the hazard. For example, the product may need to be packaged in child resistant containers.

If a chemical is considered a hazardous substance, by definition of the law, the product is subject to labeling requirements.

By definition, a hazardous substance is any substance or mixture of substances which is toxic, corrosive, an irritant, flammable or combustible, a strong sensitizer, generates pressure, is radioactive, or can cause substantial injury or illness.

It is important to note that the Hazardous Substances Act is concerned only with acute or immediate effects and does not take into consideration the long term (chronic) effects of a product. For products demonstrating an acute effect due to the result of a hazardous ingredient, the following labeling requirements exist:

a. Signal words must be used such as "danger," "warning" or "caution" depending on the level of danger. (Must appear on front label.)

b. Description of the hazard must appear, such as "vapor harmful," "flammable," etc. (Must appear on front label.)

c. A statement warning users how to avoid the hazard must appear. Example: "Use in well ventilated room."

d. A common or chemical name for the hazardous substance must appear.

e. If necessary, instructions for safe use and handling must be given.

f. First aid instructions must be given.

g. Name and location of manufacturer, distributor or repacker must appear on the label.

h. Statement, "Keep Out of Reach of Children," or its equivalent, must be used.

Activity 4

TASTE NOT, TOUCH NOT

PURPOSE: To learn the differences between items that are safe to eat and handle, and those which are not.

LEVEL: K-3

SUBJECT: Health, Science, Fine Arts

CONCEPT: Individual citizens should be stimulated to become well informed about resource issues, problems, management procedures, and ecological principles.

REFERENCE: Purin, Gina, editor. Toxics in My Home? You Bet! Curriculum on Household Toxics for Grades K-3. Sacramento, CA: Golden Empire Health Planning Center, 1984, pp. 46-49. ED, 266 948.

BACKGROUND: Poisonous items can be mistaken for food items. A display of four or more of the items mentioned below (LOOK ALIKES) should be set up. The teacher will need to determine whether or not children can smell the products of this exercise; they may want to consider the possibilities of allergic reactions. One or two products should be placed in beverage or food containers (cups, soda bottles, etc.). Make certain that the containers are capped or covered with plastic.

LOOK ALIKES

NOT SAFE	SAFE
Moth Crystals	Rock Candy
Ant and Roach Paste	Peanut Butter
Bleach, Drain Opener	Water
Slug Killer	Cereal
Disinfectant	Apple Juice
Red Furniture Oil/Finisher	Cherry Soda
Detergents	Powdered Milk
Lemon Furniture Oil	Lemon Soda
Mothballs	Marshmallows (small size)
Radiator Flush	Canned Soda (use unfamiliar brand)
Medicine in Tube	Toothpaste (use unfamiliar brand)
Pills (colored)	Candy

ACTIVITY 1:

1. Tell the children that today they are going to learn how some unsafe products can fool them into believing they are safe.

2. Tell the children that things are not always what they seem to be. Show the children the display of unsafe products. Keep the safe products out of sight. Tell the students you want them to look at the display and guess what the products are. Have the children file by and look at the display. (No touching. Teacher should decide if students will be allowed a brief "smell.") When the children are back in their seats, point to the products--one at a time--and ask what they "look like." Encourage the children to expand their answers such as, "It's in a soda bottle so it must be safe to drink," (In reality, the "soda" may be furniture oil). "It looks like candy but I've never tasted that kind before," etc. Accept all answers. If a child guesses the actual unsafe product, don't say that the child is right, just accept the answer along with all the rest and continue to ask what else the product "looks like."

3. When all the products have been discussed, tell the children that the products just fooled them (or some of them). Tell the children what each product really was and bring out its safe "look alike." Ask the children how they were fooled by the unsafe product. Emphasize how the unsafe product fooled them, e.g., the color of the product, the shape of the product, the bottle it was in, etc. After discussing the safe/unsafe products, be sure to put them away in a locked cupboard. If you have the products brought out to your car, make sure you do not store any aerosols in a hot trunk or direct sunlight. Aerosols can explode under pressure and high heat.

4. Tell children that because some unsafe products can fool them, it is important not to put anything in their mouth unless an adult gives them permission. This means they never eat things that they find on the ground or laying around the house.

5. Tell the children they are going to learn a little song about what they should do before eating things they find on the street or somewhere in their house, etc. Ask the children if anyone knows the answer (i.e., does anyone know what they should do before eating or drinking something that was not given to them by an adult?). If no one gives the answer say, "We must ask before we eat it" and that's what the song is all about.

The song is sung to the tune of "Three Blind Mice." Students and teacher may alternate lines as given below:

"WE ASK FIRST	teacher
WE ASK FIRST	students
WHAT WE MAY TASTE	teacher
WHAT WE MAY TASTE	students
EVEN THOUGH GOODIES	teacher
LOOK EVER SO GOOD	teacher
WE HAVE TO REMEMBER	teacher
AS WISE CHILDREN SHOULD	teacher
NOT TO PUT ANYTHING	teacher
INTO OUR MOUTHS	teacher
TILL WE ASK FIRST!"	teacher and students

The teacher should tell the students they are going to play a game called "just suppose." The teacher should give the class a scenario and let them say what they would do. The scenarios could be as follows:

1. Just suppose you were playing with a friend and you saw him/her pick something up off the floor and put it in his/her mouth. What would you do? Tell why.

2. Just suppose you went into your garage after mommy/daddy finished painting a cupboard and you saw an open soda bottle near an empty paint can. You were very thirsty and the soda bottle looked like it was full. What would you do? Tell why.

3. Just suppose you went into the bathroom of your home and found some tasty looking things in an opened container. You were hungry for some candy and this looked like the stuff you had last week. What would you do? Tell why.

4. Just suppose you were thirsty and found a soda bottle where mommy/daddy keeps the furniture polish. What would you do? Tell why.

5. Just suppose you were playing in the back yard with your baby brother and you saw him put something in his mouth. It looked like food but you weren't sure and mom had just finished putting some poisons out to kill some garden bugs. What would you do? Tell why.

Activity 5

ALTERNATIVE MATERIALS FOR HOUSEHOLD TOXICS:
HOUSEHOLD CLEANERS

PURPOSE: To identify and test some alternative materials to household materials that may contain toxic materials.

LEVEL: 4-6, 7-9, 10-12

SUBJECT: Science, Home Economics, Health

CONCEPT: Some materials used in the home contain materials hazardous to human health and the environment; alternative materials that are less hazardous are available for many items.

REFERENCE: Ideas suggested by several teachers.

ACTIVITY: This activity can be adapted to any of the above grade levels depending on materials and testing used.

1. Introduction

Some chemicals in cleaners may be hazardous to your health during routine use, even though exposure is only to small amounts in the air or on your skin. You can reduce the risk to your health by avoiding products containing the toxic chemicals listed below.

Organic solvents: affect the central nervous system, liver, and kidneys; many are flammable, and a few are suspected carcinogens. "Petroleum distillates" in polishes and sprays, perchlorothylene in spot removers, mineral spirits in paint thinner, and p-dichlorobenzene in moth balls are all examples of organic solvents.

Strong acids or bases: are corrosive to skin, eyes, and mucous membranes, and can react with other household chemicals. Acids are found in tub, tile, and toilet cleaners and in rust removers; lye in oven cleaners and hypochlorites in chlorine bleach are examples of high-pH corrosive substances.

Phenols and alcohols: these poisonous and flammable chemicals are the active ingredients in most disinfectant products.

Synthetic detergents: although not highly toxic, these cleaners are the household chemicals most frequently ingested by children. "Real" soaps made from animal fat or vegetable oil are an order of magnitude less toxic.

Cleaners may also contain added dyes, perfumes, fillers, aerosol propellants, and traces of ammonia and formaldehyde.

2. Select two of the materials listed below and check the labels to determine if they contain toxic materials.

   a. Air freshener
   b. Glass cleaner
   c. Oven cleaner
   d. Bleach (powder)
   e. Furniture polish
   f. Floor cleaner
   g. Drain opener
   h. Toilet bowl cleaner
   i. Metal polish
   j. Laundry detergent
   k. Car cleaner

3. Select two of the above items and design a procedure for testing alternative substances for these products. Have your teacher approve both the usual product and the substitute (alternative substances). You may want to identify and use possible alternatives other than those listed. Determine how well the substitutes work and whether there are any health or environmental problems associated with the alternative materials.

   Listed below are some alternatives. See also Table 4-1.

   a. Air freshener
      Substitutes
      Fresh flowers, herbal sachet. You should be certain people in the home are not allergic to these items.

   b. Glass cleaner
      Substitute
      Mix 1/4 cup vinegar in 1 quart of warm water.

   c. Oven cleaner
      Substitute
      Sprinkle salt on spills when warm, scrub.

   d. Bleach (powder)
      Substitutes
      Use borax or a nonchlorine bleach.

   e. Furniture polish
      Substitute
      Mix 2 or 3 parts of olive oil to 1 part vinegar.

   f. Floor cleaner
      Substitute
      Use oil soap and wet mop. Be sure to rinse.

g. Drain opener
Substitute
Pour about 1/4 cup of salt in drain. Then follow with boiling water. Repeat if necessary.

h. Toilet bowl cleaner
Substitute
Use 1/2 cup borax to 1 gallon of hot water.

i. Metal polish
Substitute
Silver - rub with dry baking soda.
Copper - mix vinegar and salt, rub.

Activity 6

BENEFITS AND PROBLEMS RELATED TO HOUSEHOLD PRODUCTS

PURPOSE: To note the variety of chemicals commonly used in the household and recognize that some must be used with care.

LEVEL: 6-12

SUBJECT: Science, Social Studies

CONCEPT: Increasing human populations, rising levels of living, and the resultant demands from greater industrial and agricultural productivity promote increasing environmental contamination.

REFERENCES: Suggestions provided by several teachers

ACTIVITY: 1. Have the class divided into teams. Assign each of the teams a category of household products as listed on Table 4-1, pages 53-56.

a. List the benefits and problems for using these products. Include health effects and environmental consequences.

Example: Pesticides

Benefits	Problems
-kill disease carriers	-may affect water quality
-make crop yields higher	-may destroy soil
-make the country more attractive	-may eventually harm human health
-kill weeds	

b. Discuss the following questions:

1) Considering benefits and problems listed, do you recommend continued or decreased use of these products?
2) Which of these products does your family use?
3) Are most of these products necessary for living?
4) Do you think your family could cut down on the use of these products? How?
5) How might your use of the products affect other people in your community?
6) What effects might restricted use of these chemicals have on the world environment?

Activity 7

SUBSTITUTES AND ALTERNATIVES

PURPOSE: To identify safe substitutes and alternatives for household toxics.

LEVEL: 4-6

SUBJECT: Health, Home Economics

CONCEPT: In many cases, alternative procedures or substitute materials may be used to avoid problems inherent in the use and/or disposal of hazardous and toxic substances.

REFERENCE: Purin, Gina, editor. Toxics in My Home? You Bet! Curriculum on Household Toxics for Grades 4-6. Sacramento, CA: Golden Empire Health Planning Center, 1984, pp. 44-50. ED 266 949.

ACTIVITY:

1. Introduce the lesson by asking students to name some potentially toxic products used in their homes to: a) clean and freshen the house; and b) take care of the yard and garden. List their responses on the board under the "a" and "b" categories identified above. Add some of your own.

2. Display advertisements/pictures of household toxics. Have the students observe the packaging and slogans used by each company to sell their product. Ask the students to recall any advertisements they have seen on TV. What was the slogan, jingle or gimmick used to sell that particular product? Why might a consumer buy these toxic products? Discuss.

3. Explain to the students that many potentially toxic products that we purchase are not always necessary, and are sometimes expensive. There are safer substitutes for some of these products available at most grocery stores.

4. Ask students if they can think of alternatives for any of the products listed on the board. Write their answers next to the corresponding toxic.

5. Explain that "simplicity is the key." Four or five safe products can usually take the place of many other household toxics. OPTIONAL: Show samples of safer substitutes and give examples of their uses.

6. Hand out the "Safer Alternatives..." sheets to each child. Read through substitutes with the class. Discuss:

   - Can students think of additional substitutes for the categories mentioned?
   - Are any of these surprising?
   - Can these substitutes be purchased easily? Where?
   - Are any of these substitutes used in their homes already?
   - Do they think their family would be willing to try an alternative? If "no," why not? (e.g., not as efficient?)

Prices of products--How do the safer substitutes compare in price to convenience products? How can convenience products be made (e.g., vinegar and water used to wash windows can be kept in a pump spray).

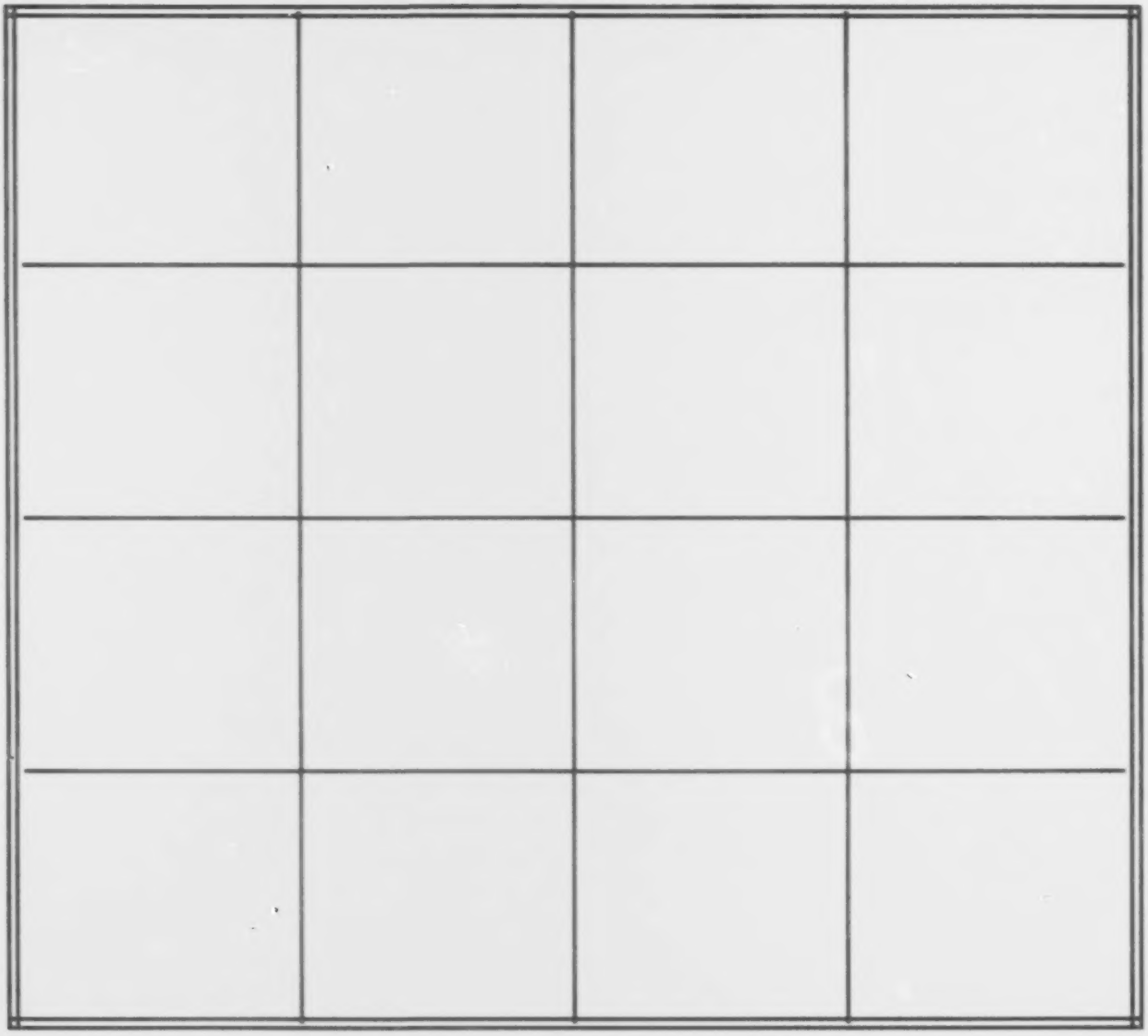
7. Tell the students that they are going to play a game called TOXIC FREE BINGO. Pass out a blank grid to each student. Each student will fill in their own grid by randomly writing a toxic product into each square of their grid. No word or phrase may be used more than once.

8. Explain that you will draw a card from the box that will have a safe substitute written on it (Master Cards are given.) You will read this aloud and the students will look for the toxic product on their card that can be replaced by this particular substitute. Example: teacher calls "baking soda." Student may place a marker on oven cleaner, deodorizer or scouring powder. Student must only choose one!

   The object is to get four in a row; up and down, side to side, or diagonally. Four corners also count as a "win."

   When you finish one game, students may switch cards and play additional games. Keep cards for future use.

TOXIC FREE BINGO



MASTER CARDS

Cut each rectangle and place in a container.

soap and water	pan with beer
lemon juice and vegetable oil	mayonnaise and soft cloth
pump-type sprayers	plunger
open windows for fresh air	plumber's snake
hot vinegar set in a dish	water based paint
baking soda	overturn clay pots
fresh cut flowers	compost
dried flower petals mixed with spices	screens
washing soda	cream of tartar
grated lemon rind	biodegradable soap
steel wool	vinegar and salt
mechanical mouse traps	brewers yeast
eucalyptus leaves	salt on spills

SAFER ALTERNATIVES FOR TOXIC PRODUCTS

The following is a list of safer substitutes for some household toxics. Generally, the products can be bought in grocery stores.

Aerosol Sprays

- Use pump-type sprays whenever possible to replace aerosols (e.g., hair sprays).
- Use fresh flowers or sachets of dried petals mixed with spices instead of room sprays.

Ant Control

- Sprinkle cream of tartar in front of an ant's path. Ants will not cross over. Cream of tartar is a substance used in baking.

Bug Spray

- Place screens on windows and doors.
- Brewers yeast tablets taken daily give the skin a scent that mosquitos seem to avoid.

Chemical Fertilizers

- Compost.

Copper Cleaner

- Pour vinegar and salt over copper and rub.

Deodorizers/Air Fresheners

- Open windows or use exhaust fans as a natural air freshener.
- A dish of hot vinegar can get rid of fish odors.
- Baking soda placed in the refrigerator reduces odors.
- Fresh cut flowers or dried flower petals and spices can add a nice scent to a room. You can also boil potpourri or cinnamon and cloves in water to produce a nice scent.

Detergents (Laundry & Dishwashing)

- Replace detergents with soaps that are relatively "non-toxic" and biodegradable. (To wash out residue from detergents, prewash in washing soda.)

Drain Openers

- Pour boiling water down the drain. Do this every week for preventive maintenance.
- Use a plumber's helper (plunger) or a plumber's snake.

Flea Repellant

° Place eucalyptus seeds and leaves around the area where the animal sleeps.

Floor Cleaners

° Use soap and water.
° Use washing soda and water.

Furniture Polish

° Use a soft cloth and mayonnaise.
° Mix 1 part lemon juice and 2 parts vegetable oil.

General Cleaners (All Purpose Cleaner)

° Mix 3 tablespoons washing soda in one quart of warm water.
° Use baking soda with a small amount of water.

Glass and Window Cleaners

° Use cornstarch and water.
° Mix 1/2 cup vinegar and one quart warm water. Wipe with newspaper.
° Use lemon juice and dry with a soft cloth.

Oven Cleaners

° Mix 3 tablespoons of washing soda with one quart of warm water.
° Place liners in oven to catch any drips during baking.
° Sprinkle salt on spills when they are warm and then scrub.
° Rub spills gently with steel wool.

Paint

° Water based paints are less toxic than metal based. After using them, no solvent is necessary for "clean up."

Rat Poison

° Put a screen over drains.
° Use mechanical-snap mouse traps.

Scouring Powder

° Dip a damp cloth in baking soda and rub.
° Use steel wool.

Snail/Slug Bait

° Place a shallow pan with beer in the infested area.
° Overturn claypots. The snails will take shelter in them during the sunny days and they can be collected and removed.

Activity 8

PESTICIDES: BLESSING OR CURSE?

PURPOSE: To identify basic information from pesticide labels and to determine toxicity levels and potential hazards associated with pesticides.

LEVEL: 7-9

SUBJECT: Science, Home Economics, Mathematics

CONCEPT: Increasing human population, higher standards of living, and resultant demands for greater industrial production promote increasing environmental contamination.

REFERENCE: Adapted from Llewellyn, Gerald C., et al. The Dilemma of Toxic Materials, Classroom-Tested Ideas and Resources for Social Studies and Science Teachers. Richmond: Virginia Commonwealth University, 1985, pp. 153-164. ED 263 015.

BACKGROUND: Pesticides literally affect every aspect of our daily lives, from the wood used in the house, the food we eat, to the home itself and to the lawns that surround the home. It can be effectively argued that pesticides have helped to raise our standard of living by providing increased production of food and timber.

This high standard of living has had its hidden price. Rachel Carson's Silent Spring explained the cost in terms of the effect of pesticides on non-target species, including man.

Pesticides do help control their target species, but they also affect other species and pass up the food-chain by bioconcentration. Since the publication of Carson's book in 1962, a vigorous debate has ensued based on the risks versus the benefits of pesticides. Each aspect of study used in this lesson will benefit by a risk/benefit analysis. The pro and con aspects should be presented for all instances.

A pesticide can be defined as any chemical used for killing insects, weeds.... This can also include animals such as rats, coyotes.... This broad definition includes insecticides and herbicides (weeds). These groups can be further divided into natural (those obtained from natural sources) and man-made (synthetic) organic compounds.

Natural pesticides were used prior to the 1940's. They were derived mainly from plants (nicotine, for example) and they broke down quite easily in the environment. Man-made organic compounds were produced on a massive scale after World War II. They are generally cyclic hydrocarbon compounds initially derived from petroleum chemistry. The most widely known (and used today, though not in the USA) is dichlorodiphenyltrichloroethane-DDT. Many other pesticides have been produced and used widely, including Clordane. These chemicals are generally long-lived in the environment. They decompose slowly.

A pesticide is used, as its definition implies, to control "pests." These pests include all types of insects (flying, crawling, burrowing), weeds, animals (rats, mice, coyotes), and fungi. They act by various means, killing by direct or indirect action on the target species. They can act through the skin/membrane, ingestion (poisoning), roots.... Pesticides are usually sprayed on the fields by tractor-pulled sprayers, through irrigation systems or by dusting from an aircraft.

The application of pesticides has increased since World War II with the conversion of agribusiness to large scale farms based on a few crops as opposed to the predecessor family farm having small scale farming and various crops.

Problems have followed this increase in the use of pesticides. Insects multiply rapidly and some species may have multiple generations in a summer. The vast numbers also guarantee a large amount of genetic variety. Thus, when fields are sprayed, many of the target species die, but some are genetically able to handle the pesticide. These few survive and breed, eventually to cause a problem again. This problem is usually handled the same way as before, by application of chemicals. The previous dosage no longer does an effective job because the target species has been "un-naturally selected." They are more resistant. This leads to an increase in dosage or the use of another pesticide and the cycle starts over again. This is an example of "forced evolution."

Pesticides tend not to be single species specific, so other insects/plants are killed also. This may allow a species formerly kept in check by natural predators to suddenly multiply and become a pest itself. Then new pesticides or dosages are needed to control the new pest.

Pesticides affect other species of plants and animals by several mechanisms. The pesticide can pass into the food chain by direct ingestion of "infested" insects or plants, or by absorption from groundwater or runoff in streams, ponds, rivers.... Because pesticides are not easily metabolized, they tend to accumulate in the tissues (bioconcentration or bioaccumulation). The effects of this can be quick, such as the poisoning of buzzards when they eat a coyote that has been controlled with compound 1080 (Sodium monofluoroacetate) or long-term, such as the decrease of bird populations due to the effects of DDT on eggs, causing them to be brittle and break before proper incubation. Sometimes, fewer eggs are laid. Also, pesticides can also affect humans. These are toxicants that can cause immediate chemical poisoning reactions when taken in large doses. Their long-term bioconcentration effects are not as well known and are currently being studied.

ACTIVITY 1. Pesticide Use Around the Home

This activity can show students how they might come in contact with pesticides in the home. It should increase their awareness of the potential problem. A survey should be made using the format suggested in the following table. The survey is a tool to help students understand how to handle pesticides safely. A cover letter should be sent home explaining the purpose of the survey and asking the parents to help the students with their project. After the surveys are completed, the results can be tabulated on the blackboard or bulletin board under general categories such as a bug spray for indoors, flea powder, rose mite dust.... Also have the class discuss general safety rules and handling. Have the students list these on poster board. Suggest that these could be posted at home for ready reference. Include the number of the local Poison Control Center. This "Safe Handling" poster could also include the names of pesticides that the students listed on their survey for their homes. Please note that we are not asking or encouraging student use or handling of pesticides in this lesson.

HOME PESTICIDE SURVEY

NAME: _____

ADDRESS: _____

DATE: _____

NAME OF PESTICIDE	LISTED CONTENTS (ACTIVE INGREDIENTS)	LISTED SAFETY PRECAUTIONS	TYPE OF PACKAGING	LOCATION IN THE HOME

Pesticide and Other Labels

Because many students come into contact with pesticides and will probably use them later in life, it is important that they know how to read completely the label on a pesticide container. To assure that students can read and understand such labels, the following activity is recommended.

Collect various containers for classroom use that are empty and clean. If students bring in empty containers be sure they are transported and handled safely. It is recommended that the teacher develop a set of slides or transparencies made from photocopies of these labels for a teaching aid. A variety of labels from drain openers to paint products may be used. Enclosed herein is a label (Figure 1) and questions from the Metro Toxicant Program as developed in Seattle. Use it as an example and then develop a similar worksheet using labels that are available to you.

Figure 1. Metro Toxicant Program Label for "Whiz Clean."

Figure 1. Metro Toxicant Program Label Written Details for "Whiz Clean."

USE WHIZ CLEAN ANYWHERE IN YOUR HOME

Bleaches Out Food Stains - Cleans and Disinfects

KITCHENS

Sinks: Whiz Clean cleans and whitens porcelain. Cleans stainless steel to a sparkle.

Countertops, Plastic Surfaces: Whiz Clean bleaches through food, beverage, ink stains. Wet sprinkle Whiz Clean, let soak for a while, then rub only as needed, rinse. Do not soak for prolonged periods.

Pots & Pans, Stoves, Ceramic Cookware: Whiz Clean cuts grease, scours off cooked-on food.

BATHROOMS

Sinks, Tubs, and Showers: Whiz Clean disinfects as it cleans.

Ceramic Tile, Fixtures: Whiz Clean cleans to a sparkle.

Toilet Bowls: Whiz Clean cleans and sanitizes. Sprinkle Whiz Clean liberally into bowl, scour and flush.

Vanity Tops, Plastic Fixtures: Special care should be taken in cleaning these surfaces. Let Whiz Clean work a minute or so with plenty of water. Rub gently if needed and rinse.

FOR TOUGH JOBS: For easiest results, let Whiz Clean work with water a minute or so, then rub as needed and rinse.

Other Uses: Whiz Clean cleans away soil and stains on cement floors, garbage cans, auto chrome, whitewall tires, out-door grills.

ACTIVE INGREDIENTS:	Trisodium Phosphate	13.50%
	Sodium Sesqul Carbonate	1.90%
	Potassium hypochlorite	0.45%
INERT INGREDIENTS:		85.15%

Includes Sodium tripolyphosphate, color, perfume, quality control agents. Whiz Clean averages 31% phosphorus in the form of phosphates.

QUESTIONS ABOUT THE "WHIZ CLEAN" LABEL

1. What is the brand name of the above product?
2. What is the product used for?
3. How does this product work?
4. List the ingredients and indicate which are the active ones.
5. How should this product be applied or used? (What are the directions?)
6. What precautions should be taken?
7. Add the % of each ingredient for the above list.
8. If you had 17 ounces of this product, how many ounces of active ingredients would you have?
9. How much actual product is used per each application?
10. If you use 3/4 ounce for each application, how long would it be until all of the container were used?
11. How much area would 3/4 ounce clean?
12. Are there any effects to human health or the environment which would result from use of this product?
13. What suggestions, if any, are given for disposal of the container?
14. Do you know of any alternatives to use instead of this product?

Using the following Figure 2 from the U.S. EPA which shows how to read a pesticide label, guide your students through several of the labels that you have on hand. Have various students in the class read one or more parts of labels. Be sure to point out to students the six main parts of the pesticide label. They are: EPA registration number; directions for use; precautions; first aid instructions; storage and disposal; and classification statement. These are explained in detail in Table 1 below. Discuss the importance and application of each part to the total pesticide poison prevention program, which such standardized labeling seeks to promote.

After all labels have been scrutinized and discussed, use the attached portion of a U.S. Government Printing Office publication, "Pesticides Are Poisons - Read The Label," on pages 94 and 95 emphasize the ideas for protecting the user and the environment by reading and following all instructions for properly handling a pesticide or other chemical agent.

Figure 2. How to Read a Pesticide Label.

Details Describing the Six Major Parts of a Pesticide Label as Written by the EPA

---

1. EPA Registration Number

   Look for this number on every product you buy. The number is your assurance that the product has been reviewed by the EPA and should be safe and effective when used as directed on the label. Older products may have a United States Department of Agriculture Registration Number.

2. Directions for Use

   Before you buy any pesticide, make sure the product is labeled for use against the pest(s) you are trying to control. Read all label directions thoroughly before you open the container. Use only the amounts recommended, at the time and under the conditions specified, and for the purpose listed. (Don't think that twice the dosage will do twice the job. It won't. You may harm yourself or whatever you are trying to protect. It is also a violation of Federal law.)

3. Precautions

   Read the precautions carefully. The most toxic products will be labeled "DANGER-POISON." The word "WARNING" on the label means the product is less toxic, but extreme care must be exercised in its use. The word "CAUTION" will appear on those products which are least harmful when used as directed. Pay particular attention to warnings about keeping children and pets out of treated areas and about special clothing that should be worn when using certain chemicals.

4. First Aid Instructions

   Know what to do if someone is accidentally poisoned by a pesticide. Check the label for "Statement of Practical Treatment." This information will give instructions for immediate action. Then, ALWAYS call or get to a doctor or hospital right away. Be sure to take the pesticide label with you. Write the name of your doctor or local poison control center here and keep it handy.

   _____ Number of Local Poison Control Center

5. Storage and Disposal

Read and follow all directions for storage and disposal of pesticide products carefully. Keep all pesticides out of the reach of children, preferably under lock and key.

6. Classification Statement

Pesticide products are classified for either "general" or "restricted" use. Restricted use pesticides are highly toxic or require special knowledge or equipment for application and, therefore, will generally not be available for sale to the homeowner. Look for the statement "General Classification" on the label at the beginning of the directions for use to ensure that the pesticide is classified for use by the general public. Remember: By reading and following all label directions and warnings before you buy or use any pesticide, you protect yourself, your family and the environment from serious accidents.

ACTIVITY 2: Survival of the Fittest

This class activity could be explained as a game of chance. When pesticides are used, some insects are able to survive by having genetic "immunity," which is then passed on to their offspring.

Have students stand at the front of a class as insects. Inform them that they will receive 10 mg of pesticide per kg of body weight. Let them draw cards out of a paper bag. All but five of the cards say, "You have been sprayed and are terminated. Please sit down." The other five cards can read, "Congratulations! You survived the spraying." Have students calculate the percent survival (those living divided by the total number in class, then multiply by 100%).

Have those students sitting down come forward again, and explain that five individuals reproduced, and they are the new colony. They are munching on the crops again, and they will be sprayed again with the same concentration. Have them draw from the bag again. This time place ten survival cards in the bag. Again have them calculate percent survival.

This activity can then be expanded by announcing that because of the increased survival, a larger concentration will be sprayed (20 mg/kg body weight). Repeat the above sets of five and again with 10 survivors. If any "student" survives all sprayings, see if the class can calculate the amount of pesticide he/she has received. This could be done for an average student weight of the entire class such as 70 kg.

Discuss the options of the farmer and ask how the students would handle this problem if they were a farmer. This could include leading questions about costs, risks, benefits, alternative means of control....

Bioconcentration

As pesticides are passed up the food chain, their concentration in the higher consumers tends to increase. This activity needs to be preceded by an explanation of the food chain or food web. A bulletin board may prove useful as a teaching aid or transparencies of various food chains/webs can be used.

Have the students withdraw labels on 3 x 5 cards out of a large grocery bag. The labels should be as follows: two cards, human; four cards, big fish; eight cards, fish; and the remainder, insect. Extra insect cards may be required for meaningful amounts of pesticides to be passed up the food chain. Have the students hold up their animal label. Divide the classroom with an imaginary line, and explain that the fish are to stay in the "water." Tell the insects that they have been sprayed and hand them a card that reads "Pesticide." They are to "fly" to the "water," where they are "eaten" by the big fish. This is done by the insects giving the big fish their label/card. The big fish are then "caught" and "eaten" by the humans who collect all of the pesticide cards. Inform the "fish" and "humans" that if they receive more than 10 pesticide cards they are to "die," and withdraw from the chain. The number of pesticide cards received resulting in death may be varied depending on the number of students involved.

Ask them to develop an explanation of bioconcentration based on this activity.

ADDITIONAL ACTIVITIES:

A collection of news articles related to pesticides can be initiated. The articles should be properly annotated and grouped according to type of pesticide.

Select one of the pesticides found in the home survey and have one of the students research the specifics on it. This could include target pest, route of action, how it was produced, how it is applied, who are the major consumers, and how effective it is.

Have a speaker from the State University Extension Service discuss the pros and cons of pesticide use from a farmer's point of view.

Read and report on a book such as Silent Spring.

Report on various natural pest control methods such as scew worm sterilization via radiation, natural predators, use of preying mantids and lady bug beetles.

Activity 9

READ THE LABEL

PURPOSE: To simulate lethal dermal toxicity and investigate the use, disposal and hazards of pesticides.

LEVEL: 10-12

SUBJECTS: Science

CONCEPT: The lethal dose rating indicates the toxicity of a pesticide.

REFERENCE: TVA-A World of Resources, Tennessee Valley Authority and Western Kentucky University, Bowling Green, KY, November, 1986.

OBJECTIVES: Students will be able to (1) classify pesticide containers by type and contents, (2) identify the toxicity of a pesticide by the container label, (3) determine the lethal dose of various pesticides by using the lethal dose rating, and (4) describe the toxicity of a pesticide as expressed by the lethal dose rating.

BACKGROUND: The term "pesticide" includes herbicides (weed killers), insecticides (insect killers), fungicides (fungi killers), rodenticides (rodent killers), nematicides (nematode killers), and molluscicides (killers of such things as slugs and snails). If label instructions are NOT followed, many pesticides could become homicides (people killers).

Each year, the use of pesticides in the United States, primarily in agriculture (but also found in lawn and garden use), totals over one billion pounds of active ingredients. If a pesticide has "10 percent active ingredients," 90 percent of the net weight of the container is inert stabilizing matter (filler).

A lethal dose (LD) is defined as the calculated amount of a substance that will kill a given percentage of test animals exposed by any route other than inhalation. For example, the LD-50 for a pesticide is the amount of that pesticide that kills 50 percent of the test animals. The LD rating is expressed in milligrams of the pesticide per kilogram of body weight (animal or human). An LD-50 rating of 100 would mean that 100 milligrams of pesticide per kilogram of body weight would kill 50 percent of the test animals exposed to that dosage.

A toxic chemical may enter the system through one or more exposure routes: ingestion (eating), inhalation (breathing), or dermal (skin) contact.

ACTIVITY 1: Pesticides can enter the body through the skin.

A. (Alternative "A") Simulating body contact with a lethal lethal dose of liquid pesticide.

1. Group the class into pairs and give each pair a copy of the student sheet "LIQUID PESTICIDES." Have students, working in pairs, measure out 32 drops of liquid from a container labeled "Substance A" (water) and 31 drops from a container labeled "Substance B" (rubbing alcohol) into a tumbler. Then add one drop of "Substance C" (food coloring). Stir thoroughly.

2. Divide the liquid evenly into two small, clear containers. Have students write a brief statement describing the odor, color, and other characteristics of the mixture.

3. Have one partner cup his/her hands, while the other pours the liquid from one container into the cupped hands. After the liquid is poured into the cupped hands, the student quickly rubs the liquid over his/her hands and wrists to spread the liquid.

4. Roles are reversed, and the other student repeats the procedure.

5. Let students think about and record the percentage of surface area of their hands and wrists that is wet after spreading the liquid. Have students close their eyes and determine whether or not they can feel the skin area that is covered. If students now have new information, have them add it to the list of characteristics they have written about the mixture.

6. Discussion: The purpose of this discussion is to help students gain a visual point of reference for determining lethal dermal toxicity.

   a. If a lethal dose of this mixture is 32 drops, what would happen to you? If this mixture is a pesticide, what should you do? (Hint: Flushing with water can dilute the pesticide below the tolerance level.)
   b. In preparing a solution of water and any pesticide with an LD of 32, what should you do to avoid having your skin come into contact with the solution? (Cover the skin.)
   c. About how many drops of a liquid will stay on your hands and wrists?

B. (ALTERNATIVE "B") Simulating body contact with a lethal dose of solid pesticide.

1. Prepare a mock-up package of pesticide by using flour and a box with a mock pesticide label.

2. Ask students to devise a procedure that will enable them to determine how much powder (mock pesticide) will cling to their dry hands. (Hint: Use a plastic lined box which has been previously weighed and weigh again after all class members have dipped their hands into the powder.)

3. Give students a copy of the student sheet "SOLID PESTICIDES" attached, to be completed.

4. Have students take turns dipping their hands into the mock pesticide, then washing it off. Have students weigh and record the weight loss of the powder.

5. Discuss the procedure for determining lethal dose and outline it on the chalkboard. Have each student write the procedure.

6. Assume the mock pesticide had an LD-50 rating of 9mg/kg. Ask the students to report whether or not they had enough mock pesticide on their hands to be "poisoned." Record on the chalkboard the number of students who did and discuss the meaning of the results. Consider also the potential for body damage as well as death.

7. Give each student a copy of the student sheet "LD-50 OF SOME COMMON CHEMICALS." List on the chalkboard the names of the pesticides students identify on their data sheets as having sufficient "poisoning power" to have poisoned them if the powder on their hands had been that chemical.

8. Discuss with the students why every pesticide that is listed on the Acute Dermal LD-50 chart would not poison them, if the same amount of powder were on their hands.

9. Ask the students for some of the reasons they think the LD-50 rating for "oral" is so much lower than for "dermal." (The lower the rating, the smaller amount of the substance needed to produce a fatal dose. If taken orally, much more of the pesticide enters the system over a short period of time.)

10. Discuss some of the appropriate ways pesticide users can protect themselves from poisoning when handling pesticides. (Cover skin, wear mask, wash thoroughly.)

ACTIVITY 2: Information about toxic materials can be applied to our every-day lives.

A. Give students the list of common farm chemicals on the student sheet "LD-50 OF SOME COMMON CHEMICALS," and the chart on the student sheet "PESTICIDES: TOXICITY CLASSES AND LETHAL DOSES."

1. Ask students to examine the list of chemicals for substances they recognize. List these on the chalkboard together with their Oral and Dermal LD-50 ratings.

2. Using the listing of toxicity classes, ask students to determine to which toxicity class each listed item belongs.

3. Have students identify two common farm chemicals for each of the following categories: Extremely Toxic, Highly Toxic, Moderately Toxic, and Slightly Toxic. Have students write the classification after each name.

4. Certain "signal" words, which identify toxic classification, are found on containers. Have students add the signal words that would be assigned to the list of common chemicals they have placed in the toxic categories.

B. Students are to identify one chemical that they have at home from the list of common chemicals.

1. Ask each student to prepare a written description of a container for that chemical.

2. Write the signal words on individual pieces of paper. Place the single words on tables about the room. When students turn in their reports, have them place the reports on the tables with the appropriate signal words for the pesticides.

3. Count the papers in each category to determine the distribution of the chemicals being reported.

   a. Record the distribution on the chalkboard.
   b. Ask students to discuss what they think is the reason for the resulting distribution. (For example, fewer Danger-Poison because....)

4. Select several reports from each pile and list the chemical, signal word, and LD-50 rating for each on the chalkboard. Have students use the table on "PESTICIDES: TOXICITY CLASSES AND LETHAL DOSES" to identify the lethal dose for a few of the chemicals.

5. With students working in pairs, have them prepare a classification table from the list of common chemicals on "LD-50 OF SOME COMMON CHEMICALS." Place each chemical into the appropriate "signal word" classification according to its oral LD-50 rating.

Extension:

Have students simulate contact with the form (solid or liquid) of pesticide that was not selected for the first activity.

Evaluation

1. List the classifications of pesticide containers and their contents.
2. List some "signal words" and define the meaning of each.
3. What does "lethal dose" mean?
4. Explain LD-50 rating.
5. What precautions can be taken so that pesticides are used safely without harm to the environment?

LIQUID PESTICIDES

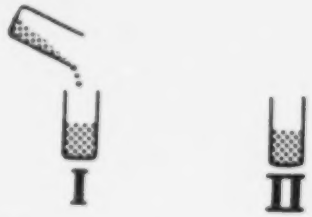
1. Measure out 32 drops of Substance A and put them into a tumbler.

2. Add 31 drops of Substance B.

3. Add 1 drop of Substance C.

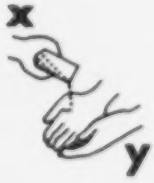
4. Stir thoroughly.

5. Describe the liquid in terms of:
   odor_____
   color_____
   other_____
   _____
   _____



6. Divide liquid evenly into 2 containers.

7. One partner (X) pours contents of container I into cupped hands of partner (Y). Partner Y quickly spreads the liquid over hands and wrists.



8. Partner Y pours contents of Container II into cupped hands of Partner X. Partner X quickly spreads the liquid over hands and wrists.

9. Close your eyes. Can you feel the liquid?

10. Over what percentage of your hands and wrists can you feel the liquid with your eyes closed?

    Partner X_____

    Partner Y_____

11. Add to No. 5 any new information you now have about the liquid.

SOLID PESTICIDES

1. Initial weight of "mock pesticide" package _____g.

2. Final weight of "mock pesticide" package _____g.

   Total weight of "mock pesticide" carried away _____g.

3. Number of students participating in experiment _____.

4. The average weight of "mock pesticide" on your hands is the total weight carried away divided by number of students.

   $\frac{\text{weight}}{\text{\_\_\_\_\_}} \quad \frac{\text{\_\_\_\_\_}}{\text{\# students}} = \text{\_\_\_\_\_ g} = \text{\_\_\_\_\_ mg}$

   To convert grams to milligrams (mg), multiply by 1000. (1000mg are equivalent to one gram.)

5. My weight is _____ lbs. (2.2 pounds equals 1 kilogram.)

   $\frac{\text{\_\_\_\_\_ lbs.}}{\text{(weight)}} \quad \frac{2.2 \text{ lbs.}}{\text{(kg)}} = \frac{\text{\_\_\_\_\_}}{\text{(weight)}} \text{ kg}$

6. NOTE: Lethal Dose is expressed in mg of pesticide per kg of body weight.

7. How many mg of the "mock pesticide" per kg of your weight did you have on your hands? (See 4. and 5.)

   $\frac{\text{\_\_\_\_\_ mg}}{\text{(wt. from No. 4)}} \quad \frac{\text{\_\_\_\_\_ kg}}{\text{(your weight)}} = \text{\_\_\_\_\_ mg/kg}$

8. Check the chart of "LD-50 OF SOME COMMON CHEMICALS" (Dermal) for the list of some pesticides. Did you have enough "mock pesticide" on your skin to be poisoned by any of the pesticides listed? If so, list them.

   _____ _____

   _____ _____

   _____ _____

   _____ _____

9. Assume that only 10 percent of the "mock pesticide" contained active ingredients. How does this change the answer and your list for No. 8? (Hint: In this case, only 1/10 of the powder's weight is a poisonous substance.)

   _____

   _____

LD-50 OF SOME COMMON PESTICIDES

HERBICIDES	ORAL	DERMAL
alachlor (Lasso)*	1800	+
atrazine	1869	+
benefin (Balan)*	10,000	---
bentazon (Basagran)*	3030	+
butylate (Sutan)*	4000	---
chlorpropham (Furloe)*	3800	---
cyanazine (Bladex)*	182	---
EPTC (Eradicane Extra)	1367	---
glyphosate (Roundup)*	4900	+
isopropalin (Paarlin)*	5000	---
linuron (Lorox)*	1500	+
metolachlor (Dual)*	2780	+
oryzalin (Surflan)*	10,000	---
pendimethalin (Prowl)*	1250	---
trifluralin (Treflan)*	3700	---
2,4-D	375	---
2,4-DB (Butyrac)*	375	+
INSECTICIDES		
aldrin	39	98
azinphosmethye (Guthion)*	11	250
carbaryl (Sevin)*	500	4000
chlordane (Belt)*	335	690
cythioate (Proban)*	160	(rabbits) 2500
DDT	113	2510
diazinon (Spectracide)*	76	455
dieldrin	46	60
endrin	7.5	15
malathion	1000	>4444
naphalene	2400	>2500
paradichlorobenzene (PDB)	500	(rabbits) >2000
parathion	3.6	6.8
phorate (Thimet)*	1.2	2.5
rotenone	50	(rabbits) 940
trichloronate (Agnitox)*	37.5	341
FUNGICIDES, NEMATICIDES, OTHER PESTICIDES		
aspirin (for comparison)	750	---
bordeaux (copper sulfate)	---	---
captan	9000	+
Paris Green	100	>2400
pentachlorophenol (PCP, Penta)*	50	**
rotenone	132	943
strychnine (for comparison)	1-30	***
sulfur (wettable)	---	---
warfarin	58	****

+ May cause eye and skin irritation

* To simplify information on this list, trade names of some products are used. No endorsement is intended, nor is criticism implied of similar products not named.

** Liquid is irritating to skin as well as being absorbed through it. Dust is irritating to the nose and eyes.

*** Nontoxic dermally. Oral threshold limit value is 0.15 ppm.

**** A single large oral dose is about as toxic as a single small dose. On a multiple dose basis, LD-100 is 0.2mg/kg/day for 5 days. Nontoxic dermally.

PESTICIDES: TOXICITY CLASSES AND LETHAL DOSES

Toxicity Class (SIGNAL WORD)	LD-50 Rating	Approximate Lethal Dose for Average Adult Size *	Toxicity
Extremely Toxic (DANGER)	1 or less	a taste, a grain	May cause death. SEE A PHYSICIAN.
Highly Toxic ** (DANGER)	1 to 50	a pinch to 1 teaspoon	
Moderately Toxic (WARNING)	50 to 500	1 teaspoon to 2 tablespoons	Serious illness may result. SEE A PHYSICIAN, if symptoms persist.
Slightly Toxic (CAUTION)	500 to 5,000	1 pint to 1 quart	May cause illness. SEE A PHYSICIAN, if symptoms persist.
Practically (NONE)	5,000 15,000	1 pint to 1 quart	
Relatively Harmless (NONE)	15,000+	Greater than one quart	

* Of the pure, undiluted compound.

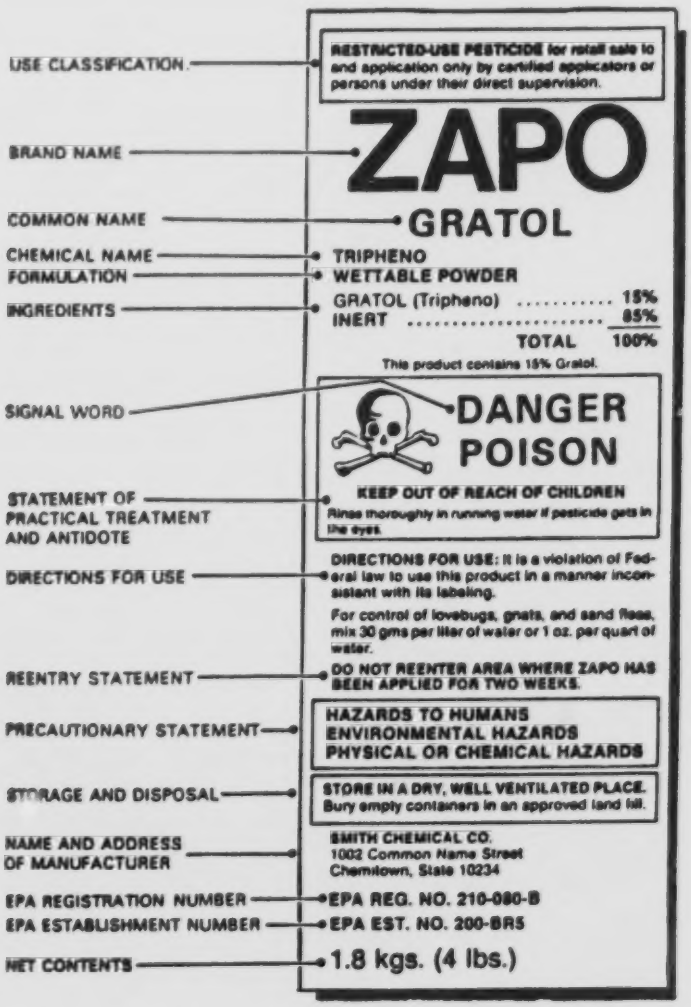
** Any compound having the signal words DANGER-POISON must also have the skull and crossbones symbol on the package label.

NOTE: 1 kilogram (kg) = 2.2 pounds (lb)
1000 milligram (mg) = 1 gram (gm)
28.3 grams (gm) = 1 ounce (oz)

APPLYING PESTICIDES

1. Read the label before you buy a pesticide!
2. Read the label before you mix or apply a pesticide!
3. Read the label before you store or dispose of a pesticide!
4. Follow instructions carefully!

INFORMATION ON LABELS — EXAMPLE


USE CLASSIFICATION
RESTRICTED-USE PESTICIDE for retail sale to and application only by certified applicators or persons under their direct supervision.
BRAND NAME
ZAPO
COMMON NAME
GRATOL
CHEMICAL NAME
TRIPHENO
FORMULATION
WETTABLE POWDER
INGREDIENTS
GRATOL (Tripheno) 15%
INERT 85%
TOTAL 100%
This product contains 15% Gratol.
SIGNAL WORD
DANGER
POISON
STATEMENT OF PRACTICAL TREATMENT AND ANTIDOTE
KEEP OUT OF REACH OF CHILDREN
Rinse thoroughly in running water if pesticide gets in the eyes.
DIRECTIONS FOR USE
DIRECTIONS FOR USE: It is a violation of Federal law to use this product in a manner inconsistent with its labeling.
For control of lovebugs, gnats, and sand fleas, mix 30 gms per liter of water or 1 oz. per quart of water.
REENTRY STATEMENT
DO NOT REENTER AREA WHERE ZAPO HAS BEEN APPLIED FOR TWO WEEKS.
PRECAUTIONARY STATEMENT
HAZARDS TO HUMANS
ENVIRONMENTAL HAZARDS
PHYSICAL OR CHEMICAL HAZARDS
STORAGE AND DISPOSAL
STORE IN A DRY, WELL VENTILATED PLACE.
Bury empty containers in an approved land fill.
NAME AND ADDRESS OF MANUFACTURER
SMITH CHEMICAL CO.
1002 Common Name Street
Chemitown, State 10234
EPA REGISTRATION NUMBER
EPA REG. NO. 210-080-B
EPA ESTABLISHMENT NUMBER
EPA EST. NO. 200-BR5
NET CONTENTS
1.8 kgs. (4 lbs.)

V. HOW SHOULD YOU DISPOSE OF HOUSEHOLD HAZARDOUS WASTES?

A. Introduction

There are several options for disposing of household wastes. Procedures include home composting, recycling, sale of items no longer desired, delivery to a hazardous waste site, delivery to a community composting site, placing the material in the usual trash collection, pouring the material down the house drain, pouring material down city drains (outside) and pouring the material on the ground, and burying the material.

Household hazardous wastes are materials to be discarded (including solids, liquids, sludges, and gases) that are toxic, reactive, corrosive, or ignitable. Hazardous wastes that are improperly disposed can pose dangers to human health and can also damage the environment.

Proper management to reduce the risks of hazardous wastes requires a variety of approaches including waste minimization, waste treatment, and disposal.

This section contains suggestions for disposal of materials and activities to involve students in learning and action.

A few precautions. If you live in an area with air pollution problems, do not evaporate materials outside; take to a waste collection site. If you have a septic tank, obtain a manual with instructions on what to place down the drain; many chemicals will kill the organisms that make a septic tank operate. If you do not have a local waste collection site, contact your state EPA or county health department for information on alternatives.

If your community has a collection program or collection sites, you should follow their instructions. If you do not have such a service, follow the disposal instructions on the container if it is a recent purchase. If you do not have community instructions or good container instructions, then you may want to refer to the suggestions below in Table 5-1.

Table 5-1

HOUSEHOLD HAZARDOUS MATERIALS
SUGGESTED DISPOSAL PROCEDURES

ITEM	DISPOSAL SUGGESTIONS
1. AUTOMOTIVE PRODUCTS	
Antifreeze	Check with your local pollution control office to determine if it is legal to pour down the drain. If yes, small amounts of antifreeze (1 gallon or less) may be taken to your local wastewater treatment plant or else diluted thoroughly and washed down your drain. If you live in the country, pour diluted antifreeze out along a fence row away from any wells and animals.
Car Batteries	Check your telephone book (yellow pages) for stores that sell batteries and take used batteries in exchange. They will either take the battery or inform you of available disposal sites. Be careful in transporting the battery. The fluid is acidic and can cause serious burns and damage to your eyes.
Auto Waxes and Polishes	Use up according to label and instructions; give away; take to hazardous waste collection site.
Auto degreasers	Use up according to label and instructions; give away; take to hazardous waste collection site.
Engine, Radiator Flush, Cleaner	Use up according to label and instructions; give away; take to hazardous waste collection site.
Motor Oil	Motor oil should be recycled. Check with a local service station or the state EPA. Plastic gallon jugs are useful containers for holding old oil for recycling.

Table 5-1 (Continued)

ITEM	DISPOSAL SUGGESTIONS
1. AUTOMOTIVE PRODUCTS (Continued)	
Rust Preventers, Removers	Use up according to label and instructions; give away; take to hazardous waste collection site.
Gasoline	Gasoline is one of the most hazardous substances found around the home because it is poisonous and flammable. Try to find a way to use up leftover, uncontaminated gasoline. If you don't have a lawnmower, snowblower, or car that needs a little gas, try to find a neighbor who can use it. If the gasoline is old, contact your service station. Some service stations will dispose of old gasoline or provide a place to take it.
2. PESTICIDES AND YARD MAINTENANCE	
Herbicides	Try to use up what you have, avoiding disposal whenever possible. Small amounts can be poured along a fence row away from wells and animals. Contact your state EPA office or local public health office for procedures to use to dispose of large quantities of herbicide.
Pesticides	Never dump leftover pesticides into soil or down drains, sewers, or septic tank systems. Also, never reuse pesticide containers. You should rinse an empty container, spray the rinse water on crops or your yard, then throw the container out with other garbage. For containers containing pesticides, check with your state EPA or local health authority to determine if they are useable. If they are not, inform them of the amount of material and ask for procedures.

Table 5-1 (Continued)

ITEM	DISPOSAL SUGGESTIONS
3. HOME MAINTENANCE PRODUCTS	
Asphalt roofing compound	Use up according to label; give away; take to waste collection site.
Paints	If the paint is still useable, donate it to a school or community organization in your area. If the paint is still liquid, let it harden by taking the lid off the can and placing it outside to let the liquid evaporate. Once the paint solidifies, you can put it in the trash. If the paint contains lead or mercury it is desirable to take it to a hazardous waste collection site if one is available.
Waterproofers	Use according to label; give away; take to hazardous waste collection site; let evaporate outdoors if not in city; and put the container in the trash.
Wood Preservatives	If the material contains chemicals such as arsenic, creosote, and pentachlorophenol the containers should be delivered to a hazardous waste collection site.
Wood Putty	Use according to label; let solvent evaporate outdoors; and put container in trash.
Varnishes	Use as instructed; take to a hazardous waste collection site.
Solvents	Small quantites of solvents (paint thinner, turpentine, varnish, stripper) can be opened and placed outside to allow the solvent to evaporate. The container can then be placed in the garbage. Do not dump onto soil, or down sewers, drains, or the toilet. Large amounts of solvents should be taken to a recycler. Contact your state EPA for a list of recyclers.
Lacquer and Thinners	Use according to label or take to a hazardous waste collection site.
Insect and Pest Sprays	Use according to label if not banned; take to a hazardous waste collection site.

Table 5-1 (Continued)

ITEM	DISPOSAL SUGGESTIONS
4. HOUSEHOLD CLEANERS	
Bleach	Bleach can be diluted and flushed down your drain. Never mix bleach with ammonia. Toxic fumes can be produced and these fumes can be fatal.
Disinfectants	Disinfectants can be diluted and flushed down the drain. Disinfectants may contain strong chemicals, so be careful when disposing of them to avoid skin contact and splashing.
Drain Cleaners	Alkalines (drain openers) may burn the skin. The best way to get rid of alkalines is to dilute them THOROUGHLY and wash them down the drain with running water. Be sure to run additional water down the drain to further dilute the materials.
Detergent Cleaners	Dilute and flush down the drain. Run additional water to dilute the material.
Floor Cleaners/Wax, Wood Cleaners, Polishes, Oven Cleaners	Small amounts of cleaners and polishes (rug, floor, and oven cleaners; furniture polish) can be disposed of in the garbage. It is best to open the container, place it outside in a safe place to let the liquids evaporate, and then dispose of the container with the solid material.
Silver Cleaner/Polish	Use or give away; take to a hazardous waste collection site.
Spot Removers	Use up according to instructions; let container air out (outside) and dispose in garbage.
Toilet Bowl Cleaner	Use or give away; dilute and flush down the drain.
Window Cleaner	Use or give away; check ingredients. If they are not very toxic, dilute and flush down the drain. Run additional water. If solids or pastes, most can be placed in the trash.

Table 5-1 (Continued)

ITEM	DISPOSAL SUGGESTIONS
5. COSMETICS	
Fingernail Polish/Remover	Use up; allow contents to dry outside; when liquid contents have evaporated, place in garbage.
6. PET MAINTENANCE	
Flea Powders, Sprays, Shampoos	Use or give away; take powders and sprays to a hazardous waste collection site. Shampoos can be flushed down the drain.
7. OTHER	
Batteries: Mercury Button Type	Use or give away; take to a hazardous waste collection site.
Medicines: Unneeded or Expired	Small amounts can be flushed down the drain with extra water; take to a hazardous waste collection site.
Mothballs	Use up in a seldom used room; store in a heavy bag for household hazardous waste collection.
Aerosol Containers	Cans placed in the trash should be empty. Do not place an aerosol can, even when empty, in a trash compactor.
Smoke Detectors (Broken)	Return these to a hazardous waste collection site (if they will accept them) or to the manufacturer or seller of the item. Most contain radioactive material.
Wood (Treated with Preservatives)	Do not burn in a fire place or toss in the trash. Material should be taken to a hazardous waste collection site.
Asbestos	Do not attempt to remove asbestos installed in the house yourself. Contact a professional removal company for removal. Items such as ironing board covers, stove mats, and other items containing asbestos can be put in garbage bags and placed in the trash.

Table 5-1 (Continued)

ITEM	DISPOSAL SUGGESTIONS
7. OTHER (Continued)	
Ammunition, Powder	Contact your local police or county sheriff for assistance in disposal. Do not put in trash. Most hazardous waste collection programs will not take explosives or ammunition.
Gas Cylinders	Butane, propane, or other pressurized gas cyclinders should not be disposed of with other trash because of the serious explosion hazard. Contact your local garbage collector regarding disposal. Tanks for camp stoves can be extremely dangerous if your garbage is incinerated. Small tanks may not be detected and can cause explosions in the incineration process.
Photographic Chemicals	If you regularly develop a large number of color photographs or black and white prints, check with your state EPA office.
Artists Paints	Containers containing most pigments can be opened, allowed to solidify and put in the trash. Containers containing the following pigments should be delivered to a hazardous waste collection site: antimony white; barium yellow; burnt umber; cadmium pigments; chrome pigments; cobalt violet (cobalt arsenate); emerald green or Paris green; flake white, mixed white, or lead white; lemon yellow; manganese blue and violet; molybdate orange; Naples yellow; thalo blues and greens; raw umber; Scheele's green; strontium yellow; vermilion; and zinc yellow.

Some general guidelines for disposal include the following:

1. Wear gloves and protective clothing to prevent skin contact with potentially hazardous materials.
2. Always read the label on items you want to dispose.
3. Dispose of materials in original containers when possible. Do not transfer to different containers unless necessary.
4. Handle the material carefully.
5. Keep hazardous materials out of reach of pets and children when disposing of them.
6. Dilute <u>any</u> liquid you are washing down a drain.
7. When disposing of liquids, put the original container within a second container.

When disposing of materials, do not do the following:

1. Breathe fumes from materials.
2. Bury or burn containers or leftover substances.
3. Mix wastes together.
4. Dispose of large quantities of any substance in a septic system.

B. Activities Related to Disposal of Household Hazardous Wastes

Activity 1 - How Do We Dispose of Our Waste?

Activity 2 - Household Toxic Substances

Activity 3 - Disposal Systems

Activity 4 - How Are Household Hazardous Wastes Disposed Of?

Activity 5 - Where Will It Go After It Goes Down the Drain?

Activity 6 - Where Will It Go After It Goes in the Trash?

Activity 7 - Exploring How Toxic Waste is Treated in the Community

Activity 1

HOW DO WE DISPOSE OF OUR WASTES?

PURPOSE: To become acquainted with the types of pollution that are caused by the disposal of solid wastes.

LEVEL: 7-12

SUBJECT: Science

CONCEPT: Pollutants and contaminants are produced by natural and man-made processes.

REFERENCE: Adapted from United States Environmental Protection Agency. Let's Recycle!, Washington, DC: EPA, 1980, p. 19. ED 188 919.

BACKGROUND DISCUSSION:

Q- What is meant by "throwing something away"?
Q- Where is away?
Q- How are waste products disposed of in our society? (Dumping, littering, burning, burying, recycling)
Q- How does our town dispose of its residential waste?

ACTIVITY: This activity should take place in a room or laboratory with the proper equipment such as goggles, bunsen burner, tongs, and a fume hood. Give instructions on how to handle and burn materials.

Proper ventilation and safety is stressed, especially for plastics.

Break the class into teams. Give each team 5 to 10 materials to burn. Prepare a data sheet or a chart for noting the initial weight and residue weight of each item burned, and the color of flame and smoke, and odors produced.

Burn a variety of household waste including food, metal, plastic, paper, etc.

Q- What are the components of the smoke? Could they be harmful?
Q- Could the smoke be filtered or cleaned to render it harmless to our environment?
Q- What are the advantages of burning our waste? (reduction in volume, breakdown of some dangerous chemicals, etc.) Could the heat generated be productively used?
Q- Does your community burn any of its waste? Does it use effective antipollution control equipment?
Q- What are the advantages and disadvantages of burning compared to other disposal methods?
Q- What are problems associated with burning wastes that contain hazardous materials?

Activity 2

HOUSEHOLD TOXIC SUBSTANCES

PURPOSE: To develop an understanding that unsafe disposal of household toxic substances may have harmful effects on health and on the environment.

LEVEL: 4-6

SUBJECT: Science, Health

CONCEPT: Safe waste disposal, including reduction of the harmful and cumulative effects of various substances and forms of energy, is important if the well-being of humans and their environment is to be preserved.

REFERENCE: Adapted from Purin, Gina, editor. Toxics in My Home? You Bet! Curriculum on Household Toxics for Grades 4-6. Sacramento, CA: Golden Empire Health Planning Center, 1984, pp. 27-43. ED 266 949.

ACTIVITY:

1. Pass out "Routes to the Environment I and II" to each to each student. Introduce the various methods of household toxic disposal:

   a. Dumping toxics in the trash.
   b. Washing toxics down the drain.
   c. Throwing toxics on the land.
   d. Incinerating toxics.
   e. Recycling waste motor oil. (Not available in all communities nationally.)

   To facilitate discussion, pass out a copy of handout 3.

   Discuss the various options given.

2. Using the handouts have each student visually trace each method of disposal. Each student may trace these methods with colored pencils/crayons to color code each disposal route.

3. As these routes are being established visually, have the students pay attention to where products go after leaving the house. For example, when something is thrown down a sink drain (handout 1), it goes to a septic tank or treatment plant and then into a waterway. Discuss the possible damaging effects each method can have on the environment or health. The following are examples:

   a. Trash goes to landfills/dumps. Refuse workers have been injured when collecting trash containing toxic chemicals. Workers at the landfill can also be injured.

b. Substances dumped in household toilets or drains (e.g., sinks and tubs) go directly into the sewers or septic tanks. The sewer systems may lead to rivers or sewage treatment plants. The sewage treatment plants, as well as septic tanks, are not designed to handle many hazardous wastes. Also large amounts of hazardous wastes may kill the living organisms in the treatment plant and septic tanks. These living organisms feed off the conventional waste (bacteria, fecal matter, etc.), thereby treating it before it is discharged to a body of water or on land. If the organisms are killed, both hazardous wastes and conventional pollutants can enter our waterways.

c. Wastes dumped in storm drains may lead directly to local waterways.

d. Wastes dumped on weeds or in holes in the ground could leach into the soil, eventually contaminating ground water.

e. Burning toxic waste can pollute the air which we breathe. It is extremely dangerous to burn products in aerosol cans. The cans explode under pressure creating a virtual timebomb.

4. Ask the class if they could think of any safe disposal methods for household toxic substances. Allow time for responses. Some responses might include "Make sure the product is all used up before throwing it in the trash"; "Maybe a neighbor could use it." If students suggest this latter remark, be sure students realize that it may not always be wise to give away all types of potentially toxic products. If some toxics are given to people who don't handle them responsibly, the toxics can damage people or hurt our environment. For instance, some pesticides are highly toxic and giving them to a neighbor who doesn't use them according to the instructions may result in undesirable consequences. Injuries or illness may occur from the person using the product openly around children or pets, not wearing the recommended protective clothing, using the product for other than its intended purpose, or overusing the product. If "recycling" of waste oil is not mentioned, suggest it. In some states, service stations will accept waste oil from the public, free of charge. The stations then sell the oil, in large amounts, to an oil recycler.

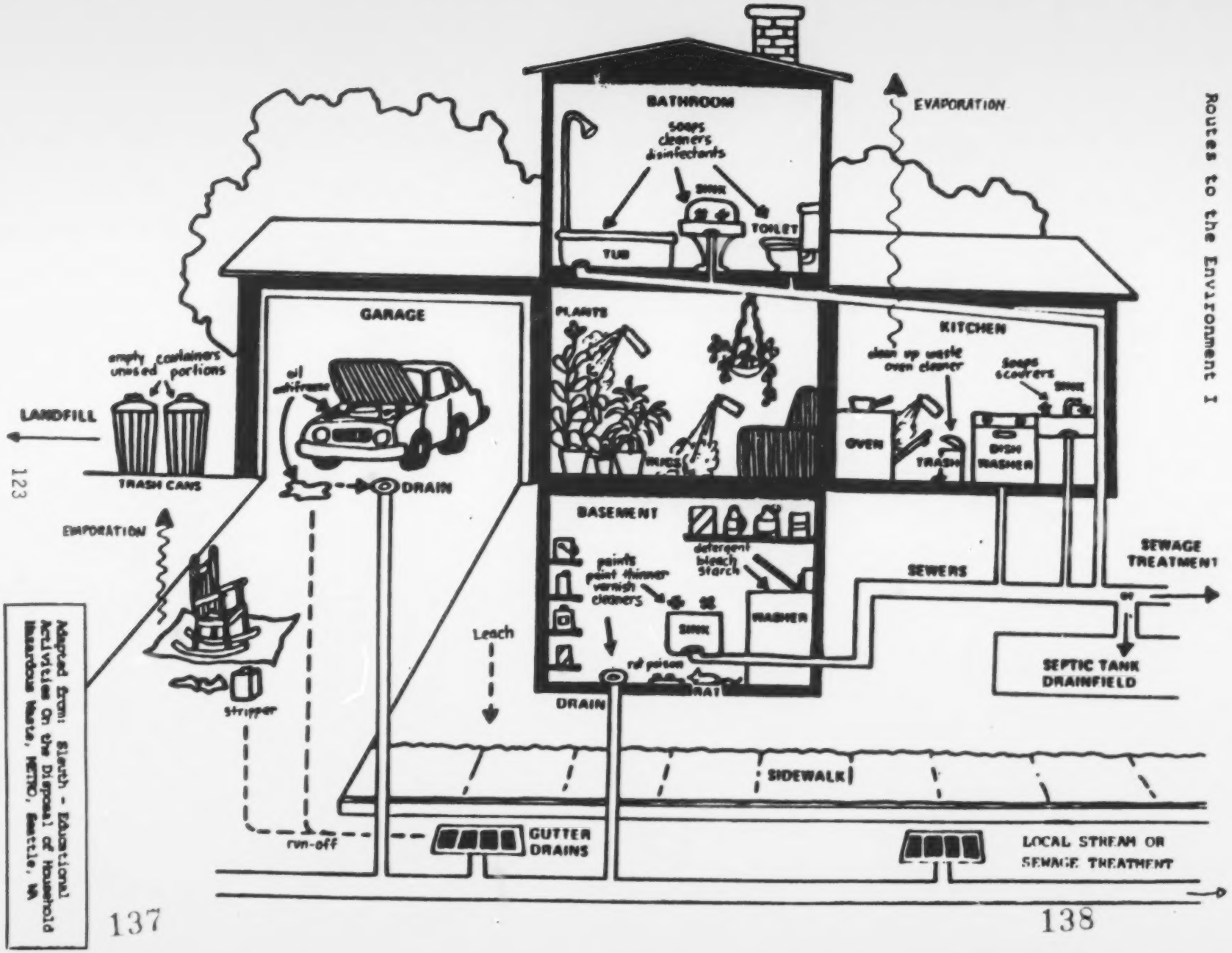
Recently, some local governments and community organizations have become interested in developing safe disposal systems for residentially generated hazardous wastes. Some cities and counties in the country have set up collection systems for household toxics. When the toxics have been collected from the public (generally at a pre-designated collection site on a given day or days), they are ultimately disposed in a facility designed to dispose of hazardous wastes. This relatively new disposal concept is taking root in jurisdictions across the nation.

5. Inform students that currently there are few alternatives for safe and economic disposal of household toxic substances. Contacting the local County Environmental Health Department, the City/County Water Quality Divisions, the State (Solid) Waste Management Board, the State Department of Health Services, City Council, or County Boards of Supervisors would be some ways of finding out what is currently being done in your community. People called hazardous waste haulers will take your toxics to a special disposal facility designed to accept hazardous waste; however, the service is generally very costly.

6. Ask the students this: If safe and economic methods of toxic disposal are not available to all communities, how can we handle the problem of safe disposal? Allow discussion time.

7. Conclude that we must be careful about <u>what</u> and <u>how much</u> potentially toxic substances we buy. We should try to use all that we buy to avoid having to dispose of toxic substances. We also could consider buying products that are less toxic than others.

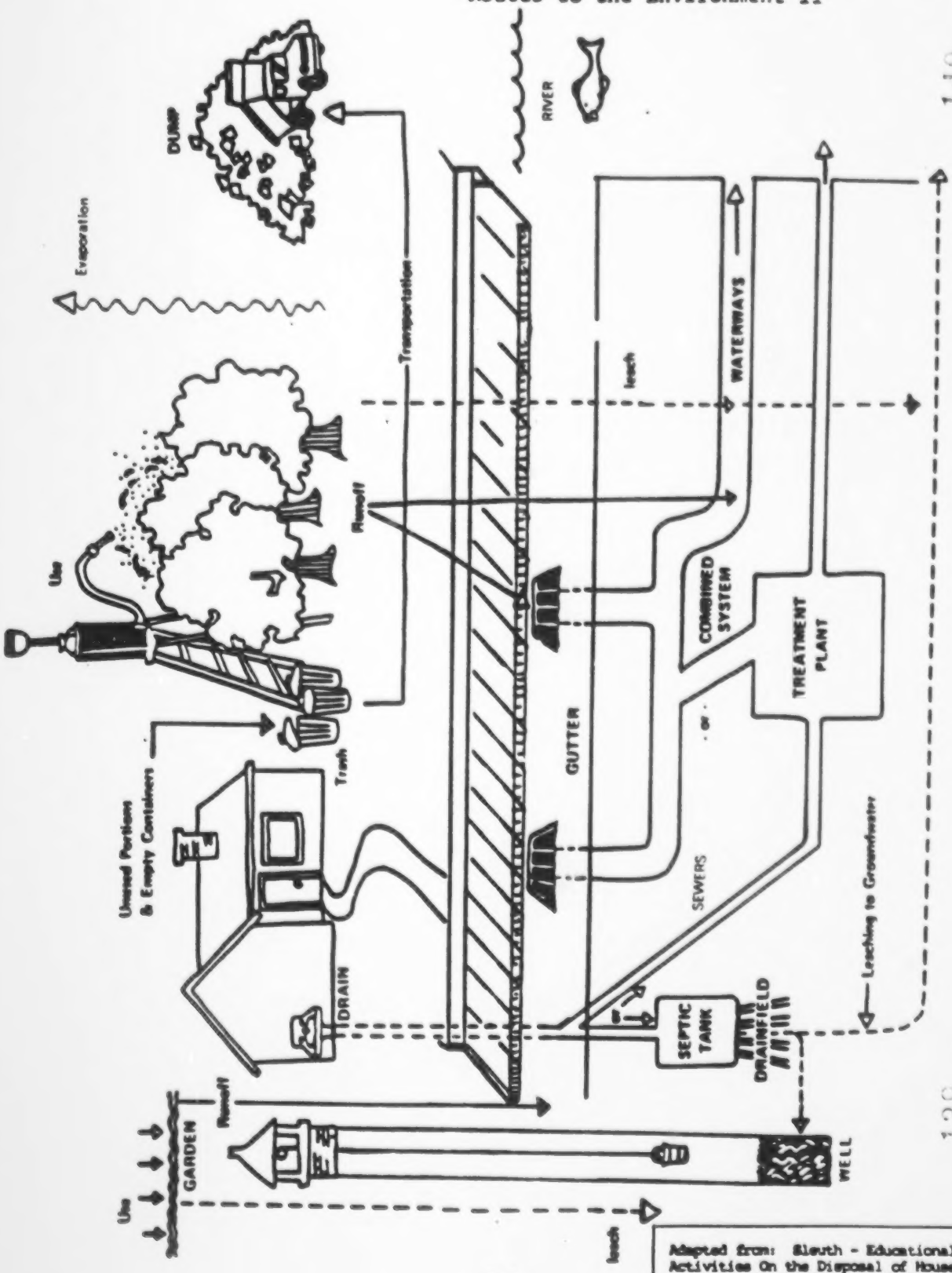
Routes to the Environment I



Adapted from: Sleuth - Educational Activities On the Disposal of Household Hazardous Waste, METRO, Seattle, WA

Handout 2

Routes to the Environment II



Adapted from: Sleuth - Educational Activities On the Disposal of Household Hazardous Waste, METRO, Seattle, WA

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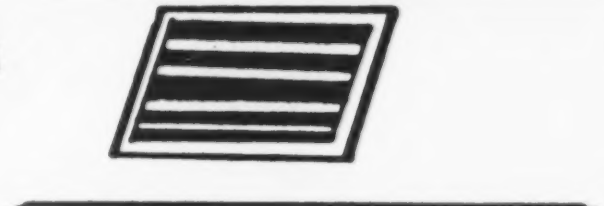
HOUSEHOLD WASTE: AVAILABLE DISPOSAL MEANS

INCINERATOR

RECYCLING CENTER

TOILET

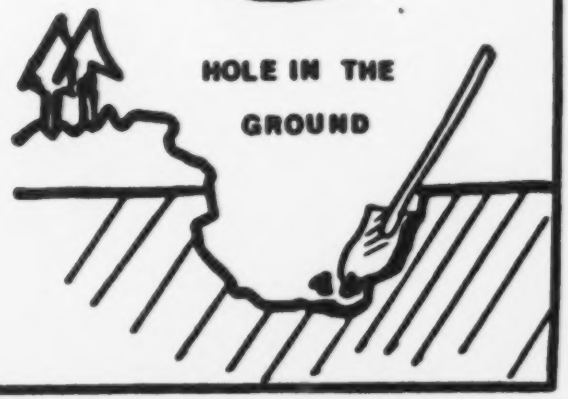


STORM DRAIN

SINK

WEEDS

GARBAGE



HOLE IN THE GROUND

Adapted from: Sleuth - Educational Activities on the Disposal of Household Hazardous Waste, METRO, Seattle, WA

Adapted from: Sleuth - Educational Activities on the Disposal of Household Hazardous Waste, METRO, Seattle, WA

Activity 3

DISPOSAL SYSTEMS

PURPOSE: To identify what happens to household wastes when they are "thrown away" and that no place is really away.

LEVEL: 7-12

SUBJECT: Science, Health, Industrial Technology

CONCEPT: (a) Household hazardous wastes can have a negative environmental health and economic impact when they are "thrown away,"
(b) no place is really "away."

REFERENCE: Adaped from materials produced by METRO, Seattle, WA.

TEACHER PREPARATION:

1. Household hazardous substances are not hazardous wastes until they enter the environment. For some products, simply using them releases the toxic product into the air, water, or ground (pesticides, herbicides, air freshener, etc.) For others, the problem does not arise until the product or container is thrown away. This activity explains three different systems into which household hazardous substances may be disposed; and discusses groundwater -- the ultimate resting place for many toxic chemicals, particularly when no system is used.

2. Make copies of Student Handouts 3A, 3B, 3C, & 3D.

3. Decide which of the following approaches would be best for your students:

   A. Copy handouts with the questions at the bottom and distribute to each student as homework.
   B. Copy handouts with the questions at the bottom. Have the class divide themselves into four groups and distribute an area of disposal or groundwater to each group. Allow enough time so they may brainstorm and/or research the answers.
   C. Copy handouts with questions covered. Distribute one area to each group and ask them to research possible sources of contamination and misuse of their form of disposal.

CLASS ACTIVITY:

1. Based on the approach you have selected, either form small groups or assign work to individuals or let individuals choose their assignment.

2. Once the work has been completed, assemble the class and allow the groups to present the information they found. Open a discussion and critique the information gathered. What parallels were discovered between groups? What were the discrepancies? What questions does one group have for another?

STUDENT HANDOUT 3A

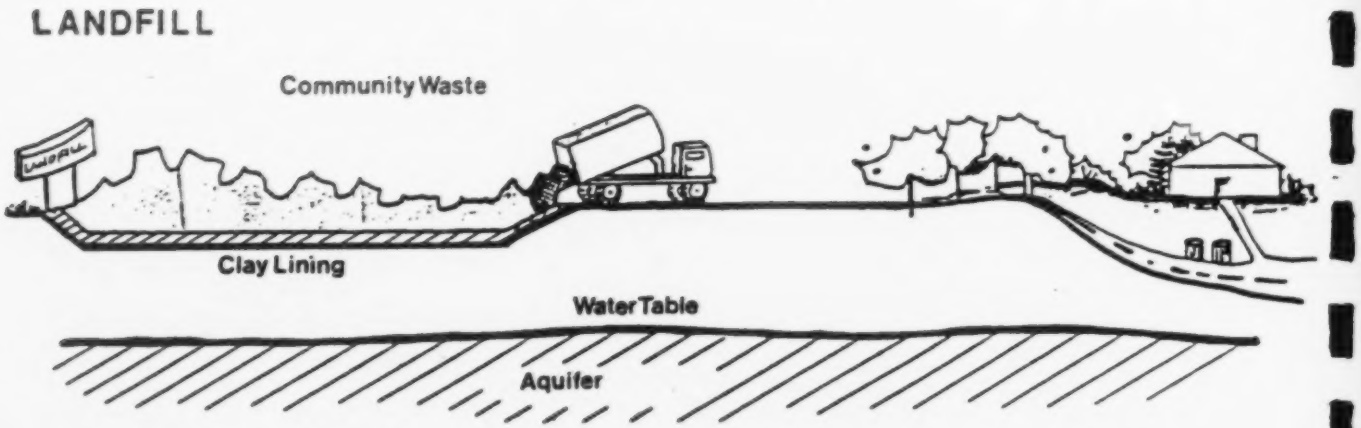
LANDFILL

Most solid waste, including improperly discarded hazardous materials, from households, schools, and businesses (paper, cans, glass) eventually ends up in the local licensed sanitary landfill. These large pits are usually lined with clay and/or industrial strength plastic to prevent leaching of contaminated water. In the past, many communities burned this waste on a daily basis, however air quality was greatly affected by this practice. Presently, the methods of compaction and burying are used. At the end of each day, the waste is smashed and covered. The process is repeated each day. Once the pits reach full capacity, they are completely covered and sealed with clay, which is designed to prevent water from percolating through the waste.

One major problem associated with landfills is that the clay and/or plastic layers do not always prevent contaminated water from leaching through. Another problem arises from the disposal of hazardous waste in local sanitary landfills. Many of these landfills were not designed to contain certain hazardous materials. Contacting your local sanitary landfill and/or hazardous waste disposal site may give additional insight.

Discussion Questions:

1. Which household hazardous wastes might be disposed in a sanitary landfill? How could these household hazardous wastes contaminate the environment?
2. What are the basic guidelines for sanitary landfills in your state and who is responsible for enforcing those regulations?
3. What are the consequences of an improperly built landfill?



STUDENT HANDOUT 3B
SEPTIC SYSTEMS

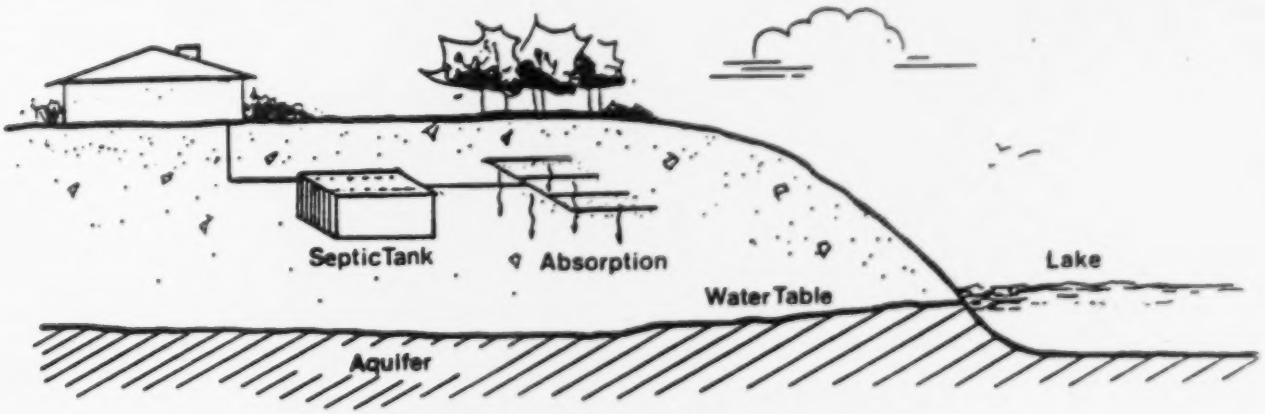
Many communities, as well as some drive-in theatres and shopping centers, operate on private septic disposal systems. Traditionally, these systems handle many of the same type of substances that are received by city wastewater treatment (waste water from sinks, drains and pipes, and toilets). These communities are usually in areas that cannot be serviced by city waste water treatment due to distance or unavailability of hook - ups. This system consists of two basic elements: a septic tank and an absorption field. A septic tank is simply a tank that is buried in the ground to collect and treat sewage. Wastewater flows into the tank where it is broken down by aerobic (utilizing oxygen) and anaerobic (without oxygen) bacteria. To continue functioning properly, the tank may need to be emptied periodically, by pumping out the built up solid waste or sludge. That material is sent to the local sanitary landfill.

The solid wastes settle to the bottom and the effluent (wastewater) flows out to the overflow pipe, it is carried by gravity through the pipe to the absorption field. An absorption field consists of perforated tiles laid in gravel or crushed stone. The wastewater or effluent travels through the perforated pipes and trickles into the soil. The soil acts as a filtering system where additional aerobic decomposition takes place. In a properly constructed septic system, the effluent should be free of organic waste by the time it reaches the water table. Some household chemicals (i.e. concentrated drain cleaners) may destroy the bacteria in a septic tank. Without the bacteria decomposing the waste, the treatment ability of the septic system decreases.

Discussion Questions:

1. List five household hazardous materials that end up in a septic system, either when used or disposed. Would the septic system be able to treat that material?
2. What are the guidelines in your community for septic system construction and maintenance? You may want to contact the city or county health department.
3. If these guidelines are not met, what may be the possible consequence?

SEPTIC SYSTEM



STUDENT HANDOUT 3C

MUNICIPAL WASTEWATER TREATMENT

The most common system for treating household wastewater (from sinks, tubs, toilets, floor drains) on a municipal level is sewage or wastewater treatment. Through a series of pipes the raw sewage from homes, businesses, and industries is carried to the wastewater treatment plant. Here the solids are removed and the effluent treated, and discharged into nearby rivers or streams. Some wastes are not allowed to be placed in the system if they might damage the operation of the treatment plant.

There are two kinds of sewer systems: separate and combined. A **separate system** collects raw sewage in sanitary lines and delivers it to a wastewater treatment plant. Rain water and materials from streets flow into separate storm water lines and are normally discharged to a nearby river or stream. If more sewage is delivered to the plant than can be handled, some raw sewage may bypass the plant or be held in a retention basin for later treatment. In a **combined system**, sanitary lines and storm water lines flow together into the wastewater treatment plant. During heavy rain storms, some of the combined rainwater and sewage may bypass the treatment plant and go directly into a stream or river without any treatment at all. In some cases it can be stored in a retention basin for later treatment.

PRIMARY STAGE

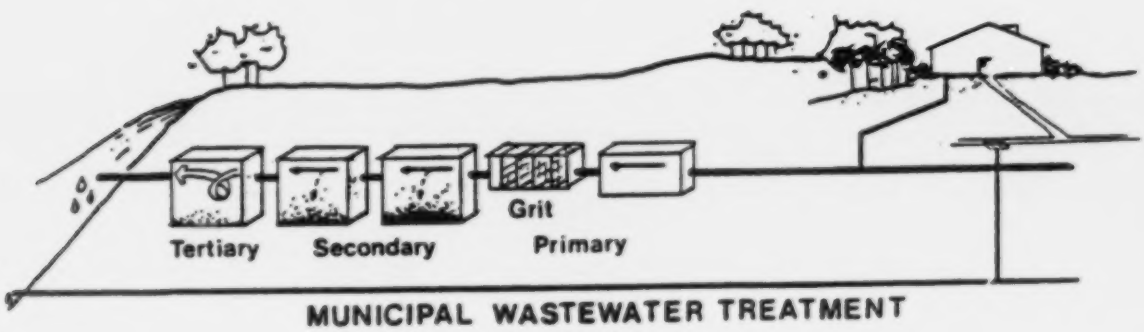
When the sewage arrives at the plant, it flows through a grit chamber which settles out large grit and particles. From the grit chamber, the wastewater flows through a series of screens which collects and shreds medium-size debris such as paper. The openings of the screens diminish in size collecting smaller and smaller bits of material. The material collected by the screen is taken to a sanitary landfill and the wastewater which passes through the screens flows to sedimentation tanks. In the sedimentation tanks, the velocity of the water is greatly decreased allowing solid material to settle to the bottom where it is scraped into hoppers and transferred to sludge treatment tanks for further decomposition and disposal in a landfill or incinerator. The effluent is now ready for secondary treatment.

SECONDARY STAGE

In the secondary stage, up to 92 percent of the organic material remaining in the effluent is digested by aerobic bacteria utilizing oxygen. Basically, the effluent is brought into contact with large numbers of live bacteria which consume a majority of the organic matter. Sprayers or bubblers add oxygen to the water to maintain a healthy environment for the bacteria. The wastewater is then sent to a final settling tank where chlorine is added to disinfect the water before returning the treated wastewater to the river.

TERTIARY STAGE

Some communities treat their wastewater with an additional third stage. Tertiary treatment systems are used to remove additional organic and inorganic material (nitrogen, phosphorus) from the effluent and to increase the quality of the plant's effluent. Sand filtration or spray irrigation systems filter most of the remaining small quantities of particles and waste material out, providing around 99 percent organic and inorganic waste removal. Some tertiary systems are so efficient that the effluent is safe for human consumption.



MUNICIPAL WASTEWATER TREATMENT

Discussion Questions:

1. State what you feel would be the advantages and disadvantages of both the separate and combined wastewater treatment systems. Which type of system does your community have?
2. What would be the consequence of releasing raw sewage into a stream or river?
3. Are there any materials that cannot be handled by this type of system?
4. List five household hazardous materials that end up in a municipal wastewater treatment plant when used or disposed. How might they effect the system?

STUDENT HANDOUT 3D

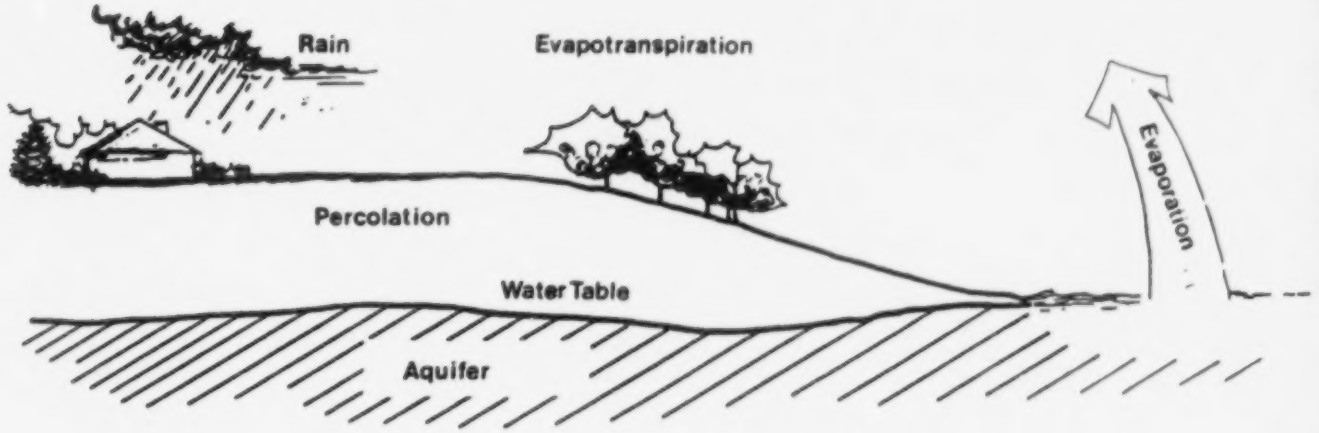
GROUNDWATER

Groundwater is the water which accumulates below the ground's surface. It percolates, or trickles down through porous soil. In some locations there are large amounts of water, called aquifers, trapped within rock formations or found in underground sand and gravel deposits. It is from these aquifers that we receive the majority of our drinking water. A variety of sources have the potential to contaminate this sub-surface water.

Aquifers and groundwater are a renewable resource made possible by the hydrological cycle. Moisture evaporates from the surface at the ground and from bodies of water (lakes, rivers, and streams) or evapotranspires from trees and shrubs. When the density of the vapor reaches a critical point, the vapor begins to form clouds. If this process continues, the clouds will release moisture in the form of rain. The rain will either be absorbed by the ground and percolate to the water table and recharge the aquifer, or it will run off the surface to a lake, river or the ocean. The surface area in which the water drains to a common location is called a watershed or drainage basin; it can be imagined as the valley between two adjoining roofs. Watersheds may be protected by local, state and/or federal legislation. The hydrologic cycle and watersheds are also highly dependent on soil conditions which determine the rate of percolation, surface cover (soil, vegetation, paving), and climatic factors.

Discussion Questions:

1. What surface and subsurface sources could result in contamination of groundwater?
2. When groundwater is contaminated, what are three consequences to humans and/or animals?
3. What are three ways to prevent groundwater contamination?
4. Once an aquifer is contaminated, how long do you think it would take to cleanse itself? What could be done to clean it?



Activity 4

HOW ARE HOUSEHOLD HAZARDOUS WASTES DISPOSED OF?

PURPOSE: To determine how household hazardous wastes are disposed of at home and changes that should be made in disposal procedures.

LEVEL: 6-12

SUBJECT: Science, Health, Industrial Technology, Social Studies

CONCEPT: Disposal procedures for household hazardous wastes depend on the ingredients included in the product.

REFERENCE: Based on suggestions provided by several teachers.

ACTIVITY: Household hazardous wastes should be disposed of in one of several ways. Some should be recycled. Some should be saved for a community hazardous waste collection or taken to a hazardous waste collection site. Some others can be diluted and poured down the drain while others can be placed in the trash.

Activity 1

Make a chart of the items listed in Table 5-1 pages 111-115.

a. Have the students determine how they dispose of household wastes at home by placing in the chart (1) for recycling, (2) hazardous waste collection or taken to a hazardous waste collection site, (3) poured down the drain, (4) put in trash, and (5) other.

b. Have the students compare their disposal techiques with those that are recommended. Explain why the more desired techniques are not used.

c. If your community does not have services to enable recycling and hazardous waste collection, what should your class do?

Activity 2

a. If your community does not have recycling or hazardous waste collection programs, divide the class into teams and have them write letters to the responsible community governmental unit (city council, mayor, county commissioners, etc.).

b. Based on the results of the survey, have the class discuss how they could help provide guidelines for homes. What are the major problems? What could you do at home to help improve proper waste disposal? (Post a list of directions in a garage, work room, kitchen; discuss with parents and others in the family; practice good disposal myself, etc.).

Activity 5

WHERE WILL IT GO AFTER IT GOES DOWN THE DRAIN

PURPOSE: To determine what happens to household wastes that are washed down the drain.

LEVEL: 6-12

SUBJECT: Science, Health, Industrial Technology

CONCEPT: (a) Household hazardous wastes poured down the drain can have a negative environmental, health and economic impact, (b) no place is really "away."

REFERENCE: Based on suggestions from several teachers.

ACTIVITY: a. Homes on sewers

If you pour something down the sink or flush it down the toilet, what happens to the material?

If you live in a city, town, or suburb your drain pipes probably (but not always!) connect to sewers. Several sewers are connected to larger pipes called trunk lines. Trunk lines carry wastes (sewage) from many homes and industries to a sewage treatment plant to clean (treat) the sewage before discharging the liquid.

1. Have the students in the class that have homes connected to sewers determine the path of sewage from their home to the treatment plant.

2. Determine how the sewage is treated and what is removed from the sewage.

3. Determine what happens to the liquid after it has been treated. What remains with the liquid after it has been treated?

4. What is done with the solids removed during the waste treatment process? What materials do the solids contain?

b. Homes on septic tanks

If you live in a rural area or outside the main metropolitan areas, material that goes down your sink probably goes to a septic tank located on your property.

1. Have students in the class that have homes connected to septic tanks prepare reports on how a septic tank operates.

2. Determine how the waste is treated in the septic tank and what is removed from the waste. How does treatment in a septic tank differ from treatment at a wastewater plant?

3. What happens to liquids that go into the septic tank? What does the liquid contain when it leaves the septic tank?

4. What happens to solids in the septic tank? What materials do solids contain?

If your class has students whose homes have both sewers and septic tanks have some students make presentations on both and discuss the differences between the two in the way materials are treated and where treated materials go.

Activity 6

WHERE WILL IT GO AFTER IT GOES IN THE TRASH?

PURPOSE: To determine what happens to household wastes that are thrown into the trash.

LEVEL: 6-12

SUBJECT: Science, Health, Industrial Technology

CONCEPT: (a) Household hazardous wastes thrown into the trash can have a negative environmental, health, and economic impact, (b) no place is really "away."

REFERENCE: Based on suggestions from several teachers.

ACTIVITY: If you toss something into the trash (garbage) and it is picked up by the sanitation department by a truck at your home, what happens to the waste?

If you live in a city, town, or suburb, your community may have substations where trash is dumped, separated and then processed in various ways.

1. Does your community require you to separate trash to be picked up at your home? If yes, what do they ask you to separate? If yes, why do they have these categories?

2. Does your community have separate collections for household hazardous waste? If yes, what do they classify as hazardous?

3. Does your community have sites where household hazardous wastes can be delivered? If yes, what do they take and what don't they take? If they have restrictions ask why these restrictions are used.

4. After trash is picked up from your home where does it go next? (For example to a sort station to be sorted, to a shredder station to be shredded, directly to a dump, landfill, incinerator, out-of-state for disposal).

5. How can household hazardous wastes create problems for personnel who pick up your trash?
   (a) If picked up by hand?
   (b) If picked up mechanically by a truck or smaller vehicle?

6. If trash goes to a substation for sorting or shredding, how can household hazardous wastes create environmental and economic problems? (Examples: wastes that get in the air of the plant; drip in the plant; containers such as aerosol cans and gas cylinders that can explode.)

7. If your trash eventually goes to an open dump, how can household hazardous waste create environmental and economic problems?

8. If your trash eventually goes to a landfill, how can household hazardous wastes create environmental and economic problems?

9. If your trash eventually goes to be incinerated, how can household hazardous wastes create environmental and economic problems? In the processing? In the smoke from incineration? In the ash from incineration?

10. Suggested Class Activity

If your community does not have procedures for collecting household hazardous wastes at the home and/or providing a site where it can be delivered - develop teams to do each of the following:

(a) Write letters to the editor for newspapers in your area stating the need for these services and that programs should be developed.
(b) Write letters to the TV and radio stations suggesting the need for these services and encouraging them to do programs on the topic.
(c) Write letters to the local government (mayor, commissioners, etc.) citing the need for the services and programs.
(d) Write letters to the public health unit of the local government encouraging them to provide the needed services.
(e) Appoint a coordination committee to coordinate the various letters and the contents of the letters.

Your class should be prepared for follow-up activities related to their letters. Follow-up activities in community action activities have included surveys, appearing on programs, working with pilot projects, etc.

Activity 7

EXPLORING HOW TOXIC WASTE IS TREATED IN THE COMMUNITY

PURPOSE: To explore how toxic waste is treated in the local community.
LEVEL: 7-12
SUBJECT: Science, Social Studies
CONCEPT: Environmental management is the result of the rational application of scientific and technical knowledge to achieve particular objectives.
REFERENCE: Goldman, Jill S., et al. Investigations: Toxic Waste, A Science Curriculum in the Participation Series. Cambridge MA: Educators for Social Responsibility, September 1984, pp. 41-42. ED 254 443.

ACTIVITY: By phone calls and/or site visits, find out the following:

1. What are the numbers, locations, and types of disposal facilities in the surrounding area? Are there old facilities, such as landfills, that are now closed?
2. Are plans for the development of new sites now being made? What are the time lines? Why are they needed?
3. Who is responsible for overseeing old, present, and projected facilities?
4. What criteria were or are used to determine the placement of the facilities?
5. How many years does it usually take to fill up a landfill in this community?
6. What companies in the area produce hazardous and toxic wastes? Where and how do they dispose of these wastes?
7. What procedures have been established for collecting hazardous wastes from homes? Are people informed of procedures? Are there monitoring procedures?

Suggested contacts for the above include:

- local sanitation department
- local Board of Health
- the state waste management agency
- the state Environmental Protection Agency, or similar agency
- local chapter of the League of Women Voters
- local industries
- local consumer protection agency
- city or county officials, state representatives, local Congresspersons.

One or more of these contacts may lead to possibilities of field trips. At least one such trip may be appropriately conducted, as an adjunct to this activity.

Activity 8

A NEIGHBORHOOD SURVEY

PURPOSE: To investigate public awareness of toxic substances and to learn how people discard toxic substances, through a home toxic waste survey.

LEVEL: 7-9

SUBJECT: Science

CONCEPT: Individual citizens should be stimulated to become well informed about resource issues, problems, management procedures, and ecological principles.

REFERENCE: Adapted from Goldman, Jill S., et al. Investigations: Toxic Waste, A Science Curriculum in the Participation Series. Cambridge, MA: Educators for Social Responsibility, September 1984, p. 36. ED 254 443.

ACTIVITY: Show the list of toxic substances Table 5-1 (pages 111-116) to your parents and ask them how they dispose of those substances. Take the list to at least three homes in your neighborhood; tell your neighbors that you are doing a toxic waste survey for school. After defining toxic waste for them and showing them the class list, provide them with a duplicate list and ask them to answer the following questions:

1. How many substances on the list did you realize could be hazardous? Put an X by each item.
2. What do you usually do with substances like these in your home? Put an a, b, c, or d by each item in your inventory to indicate what is done with materials.

    a. Throw them in the trash.
    b. Take them to the local dump.
    c. Take them to toxic waste collection sites.
    d. Keep them because you do not know how they should be discarded.

After completing your survey, answer the following questions:

1. Did your neighbors seem well-informed about toxic waste?
2. How were toxic wastes most often disposed of?
3. What was their attitude toward the survey?
4. How did you feel while doing the survey? Explain.

Compare your survey with those of your classmates. Now make a generalized statement about how home toxic substances are usually discarded in your neighborhoods.

As a follow-up, survey the teachers in the science department to find out how they dispose of toxic substances used in the lab. What kinds of safeguards do they employ? What toxic substances are disposed of? Where do they end up?

Activity 9

IN MY BACK YARD

PURPOSE: To understand methods of hazardous waste treatment and to identify those used in their community.

LEVEL: 10-12

SUBJECTS: Science, Social Studies

CONCEPT: Effective procedures are available for treating and disposing of most hazardous wastes.

REFERENCE: TVA-A World of Resources, Tennessee Valley Authority and Western Kentucky University, Bowling Green, KY, November, 1986.

OBJECTIVES: Students will be able to (1) list six methods of hazardous waste disposal, (2) rank the methods from most sound to least sound, and (3) discuss citizen responsibility in the disposal of hazardous wastes.

BACKGROUND: The first step in becoming an active, responsible citizen is to be knowledgeable about issues that affect members of the community. Citizens everywhere are affected by decisions made about hazardous waste. Hazardous waste has the potential to contaminate ground or surface water, pollute the air, burn or explode, poison by way of the food chain, or poison by direct contact. The most desirable method of waste disposal in any given location depends on many conditions (e.g., geological and social). The major purpose of this activity is for students to become knowledgeable about hazardous waste disposal methods and to use various communication skills as active, responsible citizens.

ACTIVITY:

I. Introduction

Review with students the definition of waste, the classifications of waste, and the major sources of waste.

Review with students the definition and characteristics of hazardous waste, and the major sources of hazardous waste.

II. Topical Assignments

Divide the class into 14 groups and assign research topics as follows:

1. Overview Group: historical perspective of hazardous waste disposal

2. Methods Groups:

- Secure landfills
- On-site hazardous waste storage
- Controlled incineration of hazardous waste
- Waste solvents and oil recycling
- Materials and information waste exchanges
- Composting and land application of treated wastes
- Biological treatment
- Chemical fixation
- Physical treatments
- Above-ground vault waste storage
- Illegal dumping
- Surface lagoons and storage ponds
- Deep-well injection

Each group should bring to class a list of resources for your assigned topic. Resources can include textbooks; articles; lists of community, state, and Federal agencies; and local citizen groups involved with waste disposal.

III. Preparation for Presentations

Explain to the "Overview Group" that they will serve as moderators of the reports and will summarize information at the conclusion of all presentations. In summarizing presentations, the Overview Group is to classify methods as "most desirable" to "least desirable," and state why.

Explain to "Methods Groups" that they will report their findings through short presentations which are to include the following:

1. A diagram or drawing on newsprint of their disposal method, with an explanation of how the method works.

2. A report that includes nationwide figures for (a) total volume handled, (b) types of hazardous waste disposed of, (c) cost of disposal method, (d) means of transportation to and from the site, and (e) potential for environmental contamination.

3. A discussion on the public attitude about that method of disposal, and about the general attitude of persons not wanting waste disposed of near them. This is referred to as the "Not in My Backyard" (NIMBY) attitude.

IV. Presentations

Have each group make its presentation.

V. Extension

1. Have advanced students interview local operators of hazardous waste disposal sites in their county.

2. Research and report on "Superfund" activities in your state.

3. If there is an article on hazardous waste in a local newspaper, invite the reporter to the class.

   - Where did the reporter get the information?
   - What is being done about the situation?
   - What agency is responsible for improving the situation?

VI. Evaluation

1. List six methods of hazardous waste disposal. Rank the methods from most desirable to least desirable.

2. What responsibility does a citizen have in the disposal of hazardous substances in his/her own community (backyard)?

3. How can a citizen in your community find out about the method of hazardous waste disposal?

4. How can a citizen be assured that disposal of hazardous waste takes place in a sound manner?

VI. WHAT ACTION SHOULD YOUR CLASS TAKE RELATED TO A COMMUNITY HOUSEHOLD HAZARDOUS MATERIAL USE AND COLLECTION PROGRAM?

A. Introduction

Materials containing hazardous substances are potential health and environmental problems to the user, the waste collector, and the environment in general after disposal.

Data indicate that tons of hazardous materials are washed down drains and placed in the garbage everyday. The public needs to (1) be aware of how to reduce their purchase of products containing hazardous materials, (2) learn how to use products containing hazardous materials wisely, (3) learn what materials should not be poured down the drain or placed in the trash, and (4) have a program that provides for the collection of unused household hazardous wastes in a safe way.

Effective community household hazardous use and collection programs involve establishing effective education programs to provide information to the public regarding household hazardous materials and establishing a collection program for household hazardous wastes.

A community program can improve both the health of the people and the quality of the environment both locally and regionally.

B. Student Activities

1. Encouraging your community to develop or improve an educational program related to household hazardous materials.

    a. Appoint a team to determine if your community has an educational program and the features of the program if it does.
    b. Appoint teams to contact communities that have educational programs. The state and regional EPA offices can provide names of cities and counties with educational programs. Have each team summarize the features of each community program.
    c. Have committees prepare summaries of their reports and discuss in class.

        1) What are some features of other community programs that would be good in your community? Why?
        2) How expensive would these features be to implement and maintain?

    d. Invite representatives of the local government, EPA, public health and environmental action groups to discuss their ideas regarding educational programs.

e. Have a team draft a letter to your local government with your recommendations. Discuss in class and prepare a final letter.
f. Have a team draft letters for the media (papers, TV, radio) with your recommendations. Discuss in class and prepare a letter.

2. Encouraging your community to develop or improve a collection program for household hazardous wastes.

a. Appoint a team to determine if your community has a household hazardous waste collection program and the features of the program.
b. Appoint teams to contact communities that have collection programs. The state and regional EPA can provide names of cities and counties with collection programs. Have each team summarize the features of each program.
c. Have committees prepare summaries of their reports and discuss in class.

1) What are some features of other community collection programs that would be good in your community? Why?
2) How safe is the collection and treatment program?
3) How easy is it for the public to dispose of wastes? Are they collected? Do they take them to a site?
4) How expensive would the programs be to implement and maintain?

d. Invite representatives of the local government, EPA, public health and environmental action groups to discuss their ideas concerning collection programs.
e. Have a team draft a letter to your local government with your recommendations. Discuss in class and prepare a final letter.
f. Have a team draft letters for the media (papers, TV, radio) with your recommendations. Discuss in class and prepare a letter.

VII. SELECTED SOURCES FOR ADDITIONAL INFORMATION

1. USEPA Regional Offices

EPA Region 1
JFK Federal Building
Boston, MA 02203
(617) 565-3234

EPA Region 2
26 Federal Plaza
New York, NY 10278
(212) 264-4418

EPA Region 3
841 Chestnut Street
Philadelphia, PA 19107
(215) 597-4084

EPA Region 4
345 Courtland Street, N.E.
Atlanta, GA 30365
(404) 347-2904

EPA Region 5
230 South Dearborn Street
Chicago, IL 60604
(312) 353-2000

EPA Region 6
1445 Ross Avenue
Dallas, TX 75202-2733
(214) 655-7208

EPA Region 7
726 Minnesota Avenue Kansas
City, KS 66101
(913) 276-7006

EPA Region 8
999 18th Street
One Denver Place, Suite 500
Denver, CO 80202-2405
(303) 293-1684

EPA Region 9
215 Fremont Street
San Francisco, CA 94105
(415) 556-6608

EPA Region 10
1200 Sixth Avenue
Seattle, WA 98101
(206) 442-7660

STATES BY EPA REGION

Each of the above offices serves the states listed for its region

Alabama	4	Kansas	7	North Carolina ...	4
Alaska	10	Kentucky	4	North Dakota	8
Arizona	9	Louisiana	6	Ohio	5
Arkansas	6	Maine	1	Oklahoma	6
California	9	Maryland	3	Oregon	10
Colorado	8	Massachusetts ...	1	Pennsylvania	3
Connecticut	1	Michigan	5	Rhode Island	1
Delaware	3	Minnesota	5	South Carolina ...	4
District of Columbia	3	Mississippi	4	South Dakota	8
Florida	4	Missouri	7	Tennessee	4
Georgia	4	Montana	8	Texas	6
Hawaii	9	Nebraska	7	Utah	8
Idaho	10	Nevada	9	Vermont	1
Illinois	5	New Hampshire ...	1	Virginia	3
Indiana	5	New Jersey	2	Washington	10
Iowa	7	New Mexico	6	West Virginia	3
		New York	2	Wisconsin	5
				Wyoming	8

2. Other

Center for Science in the Public Interest
1501 16th Street, NW
Washington, DC 20036
(202) 332-9110

Citizens Clearinghouse for Hazardous Wastes, Inc.
P.O. Box 926
Arlington, VA 22216
(703) 276-7070

Concern, Inc.
1794 Columbia Road, NW
Washington, DC 20009
(202) 328-8160

Institute for Local Self-Reliance
2425 18th Street, NW
Washington, DC 20009
(202) 232-4108

League of Women Voters
1730 "M" Street, NW
Washington, DC 20036
(202) 429-1965

US Consumer Product Safety Commission
5401 Westbard Avenue
Bethesda, MD 20816
(301) 492-6800

Water Pollution Control Federation
601 Wythe Street
Alexandria, VA 22314
(703) 684-2400

World Watch Institute
1776 Massachusetts Avenue, NW
Washington, DC 20036
(202) 452-1999

VIII. SELECTED REFERENCES

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A Citizen's Guide to Radon: What It Is and What To Do About It. USEPA, US Government Printing Office, Washington, DC, 1986. ED 314 233.

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Appendix 16

END

U.S. Dept. of Education

Office of Education
Research and
Improvement (OERI)

ERIC

Date Filmed

March 29, 1991